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THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

(WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE.")

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S., &c.

VOLUME XXVI.—1872.

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THE CHEMICAL NEWS.

VOLUME XXVI.

EDITED BY WILLIAM CROOKES, F.R.S., &c.

No. 658.—FRIDAY, JULY 5, 1872.

THE PROPOSED ASSOCIATION OF MANUFACTURING CHEMISTS.

It has been suggested by a correspondent in our issue of last week that considerable advantages would result to manufacturing chemists and their managers by the formation of an association devoted to the interests, commercial and technical, of chemical industry. It is our purpose to submit to our readers a more prominent notice of this suggestion, according as it does with views long held by us.

There are but few industries that have no representative body, and amongst these few ranks manufacturing chemistry. That manufacturing chemists should not be represented by any general association is not so strange as, on first consideration, it may appear; for the utilisation of by-products, by which manufacturing chemistry has attained much of its important commercial standing is a recent event in the chronology of chemical industry. But now, as our correspondent writes, "the time has come for an Association of Manufacturing Chemists, holding an annual gathering, at which the manufacture of at least the great staple, sulphuric acid, might be discussed, scientific and technical papers of general interest read, and problems of various kinds considered." The benefits that would accrue to the manufacturers themselves from membership of such an association it is difficult, from the variety, to enumerate. In the first place, the expense of many useless experiments would be saved by reference (in after-time) to the collected papers of the association, and especially by personal reference during a meeting of the chief or sub-associations. For we anticipate that the necessary result of an annual meeting would be the formation of auxilliary local associations in the several centres of chemical industry. Not only would the manufacture of sulphuric acid, chlorinated products, ammonia, economic heating, construction of plant, &c., receive their due amount of attention—more than now, because inventors or introducers would be brought into closer contact with manufacturers on the large and small scales, receiving notes of failure or hints of improvement where their processes were employed—but data upon which might be founded remunerative utilisations of by-products would probably be evolved. At present, save in rare instances, there is little communication on points of detail between manufacturers, yet no one better than the manufacturer knows the essential and expensive character of such detail, upon which the successful issue of his process not unfrequently depends. As we have said, an Association of Manufacturing Chemists would form a medium for the interchange of this detail. While, as our correspondent observes, there may be numerous methods of a kind which manufacturers never dream of patenting, and which they would be glad to exchange and reciprocate with others.

It may be advanced that the preclusive character of certain "trade secrets" would form an insuperable obstacle to the smooth working of the association. We do not think so. The day for the preclusion of knowledge in any department of science has almost passed away, for, except in isolated cases, in any process where the demand for the result is pressing, it is more than difficult for the manufacturer to prevent some clue falling into the hands of others. Moreover, our patent regulations are at least sufficiently stringent to remove serious objection from this side of the question. Of course, no manufacturer would give countenance to the exposure of the results of experiment while these results were still experimental and unpatented, whether the account were from his own laboratory or illicitly from that of others. Another point is that manufacturers would for their surplus stock of information on points useful to others gain an interchange from the surplus stock of others information useful to themselves.

The Association, it is needless to remark, would in no way trespass upon the ground occupied by the Chemical Society, for it would discuss questions of prime cost and market price that a purely scientific society cannot consider. But we need not argue upon contingent results alone, for, besides the Iron and Steel Institute mentioned by our correspondent, we could indicate several instances of the benefit accruing to manufacturers from their combination; indeed, it may be asked, is not the advanced state of technology an effect of combination, either actually or virtually, by means of quickened channels of communication. Many other inducements to the formation of such an association, some of which have been hinted by our correspondent, we cannot consider here, nor is mention necessary, for they will form individual incentives to the consummation of the proposal.

Finally, we throw open the columns of the CHEMICAL NEWS to the discussion of preliminary arrangements, and earnestly invite the correspondence of Manufacturers and their Managers upon the subject, feeling that in so doing we are co-operating with them in advancing the interests of chemical industry.

CHEMISTRY AND THERAPEUTICS.

In an address on this subject delivered last year by Dr. Hofmann to the Medico-Chirurgical Society of Berlin, the lecturer gave an account, at the outset, of the progress of chemistry in study of the hydrocarbons, and showed how chemical analysis had led to a knowledge of the active principles of medicines that had long been in use. Referring to the advantages accruing to therapeutical science from a study of chemical transformations, he spoke to the following effect :—

"There are a number of substances which can be extracted from organic matter only in very small quantities, and in a somewhat impure state. The study of chemical transformations enables us to obtain large quantities of these perfectly pure, and with little expense. Discoveries of this kind form a very interesting episode in organic chemistry."

During the last thirty or forty years the attention of chemists has been largely directed to alcohol; and the researches of Dumas and Liebig on the subject are well known. Dumas discovered in wood-spirit a new alcohol, having properties analogous to those of spirit of wine or *ethylic alcohol*, and he gave it the name of *methylic alcohol*. The chemists then began to see that they had in these two, ethylic and methylic alcohol, the prototype of a large class of substances, the most important among organic combinations. Then commenced an eager search after new alcohols, which has hardly abated up to the present. The various parts of organic chemistry have been explored with this object, and the search was not long without result. In an oily liquid obtained in the manufacture of alcohol, as an accessory of the fermentation of sugar, and which, on account of its bad smell, is carefully separated from the spirit of wine, Cahours found a third alcohol, and the rejected product came to acquire high scientific importance. This was *amylic alcohol;* also found in oil of potatoes. It has all the properties of other alcohols,—and when subjected to oxidating agents, produces an acid, in the same way as methylic alcohol is changed into formic acid, and ethylic alcohol into acetic acid. What was the surprise of chemists, on finding that this acid was the same as that obtained in very small quantities from the root of valerian! And as soon as science showed that this expensive substance could be prepared from oil of potatoes, it became the object of an important industry. Its salts, especially the valerates of zinc and bismuth, are now largely used for medicinal purposes.

Among the organic acids earliest known to chemists was *lactic acid*. Scheele first observed it in acid milk; it was afterwards found in gastric juice, sourkrout, and the juice of cucumbers. But it was not till the relation between sugar and lactic acid became known, and the acid was proved to form only at the expense of saccharine matter; it was not, in short, till the conditions of its manufacture were known, that it was introduced into therapeutics, and now, in the form of lactate of iron, plays such an important part.

A similar case is that of *succinic acid*, though it is not so much used in medicine as lactic acid. It was formerly obtained by dry distillation of yellow amber, but in very small quantities, and with many impurities. No such costly method is now followed. Analysis proved that the molecule of succinic acid differed from that of malic acid only by the atom of oxygen. Now it was shown by Dessaigne, that there is in the berries of the *Sorbus aucuparia* (or quickbeam), an abundant store of malic acid, which can be transformed into succinic acid by a simple process of fermentation. All the succinic acid of commerce is produced thus.

The manufacture of *benzoic acid* has undergone a transformation not less remarkable. The nature of this acid only began to be known in the end of last century. It was formerly extracted almost exclusively from benzoin; but very little of it is now obtained in this way. In 1829, Liebig discovered in the urine of herbivorous animals the acid called *hippuric acid*, and which is transformed by fermentation into benzoic acid. Later, Dessaigne proved that the same transformation was obtained by boiling with concentrated hydrochloric acid, in which process a very interesting secondary product is obtained, viz., *glycocol*.

Another acid deserves notice, though less important in therapeutical science, viz., *formic acid*. Chemists have found in distillation of oxalic acid, a source which furnishes this acid much more readily and in a purer state than the bodies of the insects from which it takes its name.

The remarkable properties of *glycerine* are ever finding new applications in pharmacy. It was discovered by Scheele in 1783, but it is only since the classical labours of Chevreul on fatty substances have enabled us to understand, in all its simplicity, the process of saponification, that the industrial preparation of fatty acids and of glycerine has been undertaken with success. Since the adoption of aqueous saponification, the employment of glycerine has been largely extended.

And it is not only from the direct employment of glycerine that therapeutical science has reaped advantage; it has also been benefitted through the study of its transformations, which chemists have recently investigated with great success.

It has been long known that the irritating properties of the flour of mustard are due to an æthereous oil, which may be obtained by distilling mustard with water. M. Will determined the nature of this oil. He found it to contain, in combination with sulphur and cyanogen, an organic radical called *allyl*, and which had already been met with in other substances,—in oil of garlic *e.g.*, where it combined with sulphur to form sulphide of allyl. In studying the action of iodide of phosphorus on glycerine, Berthelot observed the formation of a substance in which this radical unites with the iodine to form iodide of allyl; and thereupon occurred the idea of accomplishing the synthesis of oil of mustard or allylic sulphocyanate, by causing a metallic sulphocyanate to react on iodide of allyl; and, in fact, by distilling this iodide of allyl with sulphocyanate of potassium, oil of mustard is obtained with all the characteristic properties of that which is furnished by the plant. Oil of mustard is now mostly prepared in this manner.

Another synthesis may here be briefly alluded to. The *Cochlearia officinalis* furnishes an oil known to pharmacists as spirit of cochlearia. This oil has recently been shown to have a constitution analogous to that of oil of mustard. It is *sulphocyanate of butyl;* a combination which is easily produced artificially.

The instances that have been cited may suffice to show that the study of transformations in organic substances has been the origin of more simple and less costly methods for the preparation of substances the curative effects of which experience has demonstrated.

A. B. M.

WHAT IS THE ATOMIC WEIGHT OF INDIUM?

By S. E. PHILLIPS.

The popularisation of science is one of the cheering aspects of the present age, and the Royal Institution is at once one of the highest and most efficient of guides in the new department. The science of chemistry has two parts, which often wisely involve distinct professorships: one of laboratory manipulation,—the technical art; the other of chemical philosophy, whose aim is the collocation and orderly arrangement of the accumulating infinitude of facts. With an ardent and loving aptitude for manipulation and details, the amateur is not absolutely excluded from the former; but his more legitimate

position is undoubtedly with the latter. The *rôle* thus assigned is, however, one of extreme difficulty, apart from the conflicting necessities of daily life and business; and he is often compelled to proceed with a trembling uncertainty from the paucity of means of research.

It was under this impression that I offered some brief remarks on the character and limitations of the factors which conjointly determine the atomic weights of chemical science (CHEMICAL NEWS, vol. xxv., p. 63), and the same feeling now prompts the present inquiry.

All Professor Odling's efforts have a characteristic neatness, elegance, and force, commensurate with his high position and attainments; it is therefore the more unwelcome when an outside amateur cannot indulge in unmixed admiration. Although "the quantity of indium which unites with 8 parts by weight of O and with 35·5 of Cl, was found by Winkler to be 37·9 and by Bunsen 37·8,"* yet up to very recently the atomic weight has been regarded from the diatomic point of view, and recorded as 75·6. Of the reasons for this I am wholly ignorant, and it now appears that the vapour density has not yet been determined!

The notations given were thus—

In 76·53	$2KCl+InCl_2$
Nitrate	$In+2NO_3$
Sulphate	$In+SO_4$

A cursory glance of these types naturally suggests the following, in old notation:—

	KCl+InCl
Nitrate	$InO+NO_5$
Sulphate	$InO+SO_3$

Meanwhile M. Bunsen has determined the specific heat constant to be 4·3 instead of the hypothetic normal of 6·5, and, multiplying the atomic weight by 1½, he gives the following:—

In 113·4—		In 37·8.
The chloride	$InCl_3$	InCl
The yellow oxide ..	In_2O_3	InO
The normal hydrate	InH_3O_3	$InO+HO$
The nitrate	$In(NO_3)_3$	$InO+NO_5$
The sulphate ..	$In_2(SO_4)_3$	$InO+SO_3$
The black oxide ..	InO_2	$InO+In_2O_3$ or In_3O_4

which I have compared with my *á priori* projection. The manuals published in 1869-70 state that indium is 75·6, and combines with 2Cl, &c. Those in 1870-71 affirm its atomic weight to be 113·4, and that it is tri-atomic, &c. And the burden of my inquiry is, whether this easy method of altering the alphabet of the science, without a careful regard to all the factors which affect the result, is wise.

Among these factors, and in addition to the non-volumetric determination, I complain not that the Professor has omitted all reference to the specific refractive index, but I do take exception to the invalid apology for excluding the all-important reference to the chemism of the subject, as also a total disregard to the simple and crucial electrolytic determination.

On the contrary, I maintain that the general types of combination are determined by the position in the electro-series, and that a glance at the above notations naturally suggests the hypothesis of a mono-chloride rather than a bi- or tri-combination. While thus apparently ranking with the lowest and simplest type of salts, yet the black oxide would indicate a high position in those relations, perhaps considerably above either hydrogen or copper. At the same time it must be confessed that from such a slender series only very provisional indications can be fairly deduced, and the danger of reasoning in a vicious circle herein should be sedulously suspected.

It may be well, before attaching value to such indications, to compare the stranger with some well-recognised bi- and tri-atomics. Gold, *in relation* to O or Cl, is most definitively tri-; but that it is so *per se*, or that it therefore is equivalent to or replaces 3H, is a matter of which I find no evidence whatever. Any present list of gold combinations, or any imaginary slender list, before its relations were so well understood, would exhibit auric acid AuO_3 or $AuCl_3$, as more like sulphuric acid than any imaginary oxide or chloride of indium. Or, if we similarly compare the well-known binoxides or bichlorides of mercury or platinum, and try to divest ourselves of the accumulated facts in illustration of their electro-positive or combining functions; how very early it was seen that these chlorides tended to the formation of negative or acidulous characters in the chloro-platinates, &c.

If indium becomes a normal tri-oxide or tri-chloride, then its electro-position must be higher than mercury or platinum, or even carbon; and where are the facts leading at all in this direction? Its slender provisional portrait gives no such indications, and its weakly basic character is proclaimed in every feature. But then M. Bunsen says its specific heat constant is 4·3 instead of 6·5, and that its atomic weight must be multiplied by 1½. Be it so, if other factors point in the same direction, but the corresponding constant of chlorine is exactly 4·3, and that of nitrogen and hydrogen rather less, and there is no attempt to make these conform!

Referring to the volumetric factor, N is one vol., and its close chemical analogue P = ½ vol. Now this anomaly vanishes in their compounds, and ammonia or phosphonia both equally evince the normal 2 vols. Had this mysterious multiple discrepancy, of which we have many other instances, been ruthlessly rectified, as some have wished, by a doubled atom, then, besides disturbing the whole range of chemical congruities, all subsequent combination volumes would have been similarly deranged.

I anticipate that a similar state of things will be found to subsist with the similar multiple variations of the specific heat factor; and that the mysterious initial discrepancy will often vanish in the compounds, or conversely be disturbed in cases where inconsiderate changes have been made in violation of other and higher elements in the equation.

I am very sorry to be tempted to speak in advance, and to reason so much on such a restricted basis of fact, because a fuller knowledge may show that the normal chloride of indium is either a bi- or a tri-combination; but my inferences from the present limited facts are—

1. That the weight of indium exchanged in the voltaic circuit will be 37·8.
2. That the weight which corresponds to or replaces one H or other analogous element, in substitutional types, will be 37·8.
3. That the volumetric determination may be in agreement with that of H, either initially or in some of its compounds, and represented by 37·8.
4. That the electro-position and consequent reactions will bespeak a status adjacent to, but lower than, aluminium.

One word, in conclusion, on the studied suppression of the chemism of the subject, a factor of by far the greatest value in the whole series. How characteristic this is of modern methods we have pointed out in respect of the Hofmann treatise.

"He uses the word Chemism to express the dynamical or atomic forces involved—as we think—in all chemical phenomena; but the reference is only made once, near the end of the book, and then only in a parenthetical way, as if to show its irrelevance, while pourtraying the atomic or diatomic mechanism of varied atomicities, varied quantivalences, of atom-fixing powers or points, &c."

In regard to the higher value of the volumetric consideration, it should be observed that the protochloride of mercury is 2 vols., as well as the bichloride; and, still further, that the really corresponding chlorides of platinum are both 1 vol.!

* Professor Odling's Lecture at the Royal Institution, "On Indium," (CHEMICAL NEWS, vol. xxv., p. 266.)

It may suit a numerical progression to treat it otherwise, and double the atoms to get the required volume, but what are the chemical facts? The chlorhydrargates and chloroplatinates, with the corresponding oxy-salts, are all strictly analogous both in type and function, although constituted of such diverse volumetric metals; and, what is far more to the point, these atoms or equivalents similarly exchange in the voltaic circuit, and their chemical substitutions in varied ammonias or other hydrocarbon radicals similarly correspond; and the implied ½ vol. Pt quite agrees, both chemically and volumetrically, with the 2 vol. mercury.

Chloride of Ammonium.	Chloride of Atmonium (type).
H_3H NCl.	H_6H N_2Cl.
H_3Pt NCl.	H_6Pt N_2Cl.
H_3HgNCl.	H_6HgN_2Cl.

Similar considerations apply to the aluminium chloride, which Dr. Odling gives as a trichloride, but which modern entanglements mostly regard as a hexachloride.

The Mendelejeff-Odling tabular series, however, bristle with such incongruities, and demand a separate notice.

ON ÆSCULIN.

By ROBERT F. FAIRTHORNE.

This principle is easily separated by the following process:—A quarter of a pound of horse-chesnut bark in moderately fine powder is moistened with half a pint of a mixture composed of three ounces of solution of ammonia (U. S. P.), and five ounces of water. This is packed in a glass percolator, in the neck of which a plug of cotton has been placed. A pint and a half of a weak solution of ammonia is poured on the bark, and allowed to pass slowly through.

The first half-pint of the liquid that displaces is set aside in a capsule and evaporated spontaneously until reduced to a syrupy consistence. The remaining pint is brought to the same condition as the first portion, by means of a sand-bath and gentle heat. These products are then mixed with one and a quarter ounces of pure alumina by rubbing together in a mortar. Allow the mixture to dry, which requires a few hours. Powder the dried mass, and boil it for five minutes in a flask with six ounces of alcohol (95 per cent). Filter this whilst hot, and pour six ounces more of boiling alcohol on the residue in the filter. Place the filtered liquid in an evaporating dish, and allow it to evaporate spontaneously until reduced to a semi-solid state, when impure æsculin will be found in a crystalline condition contaminated with some dark-coloured extractive matter.

In order to separate the æsculin from the colouring matter without loss, mix two ounces of cold water with it in the capsule, and having scraped it thoroughly from the bottom of the vessel, pour it into a vial. Add one fluid ounce of ether to this, and agitate for a few minutes. Allow it to remain undisturbed for twenty-four hours. Afterwards pour the mixture on a filter, and when the dark-coloured fluid and the ether have passed through, wash with about two drams more of cold water.

The æsculin is now nearly pure. In order to make it perfectly so, all that is necessary is to allow it to dry in a warm place, powder it, pass half an ounce of pure benzole through it after having been placed on a filter; then treat it in the same manner with an ounce of ether so as to remove any paviin that may be present, that substance being readily dissolved by ether.

Sixteen grains appears to be the average weight of the purified active principle obtained from 4 avoirdupois ounces of the horse-chesnut bark by this process. After trying various methods for extracting æsculin, I found none so satisfactory as this one, either in regard to simplicity, the quantity yielded, or the quality of the production.

Æsculin, as thus prepared, appears to the unaided sight, as an amorphous powder, almost white, being of a slightly pale buff shade. Under the microscope (magnified 220 diameters) it is proved to consist of minute needle-shaped crystals.

From its alcoholic solution its crystals arrange themselves in stellular tufts, the aciculæ, pointed at the ends, radiating from a common centre in every direction, forming a very beautiful object, the transparent prisms glistening with more than ordinary lustre.

I find that it is soluble in the following liquids:—Alcohol, acetic ether, strong acetic acid, solution of carbolic acid, solution of the hydrate of chloral, and in the alkaline solutions.

When æsculin is added to nitric acid it becomes yellow, and if ammonia in excess is added to this mixture a bright cherry-coloured liquid is produced. When sulphuric acid is substituted for the nitric acid, and ammonia added, the same colour appears.

NEW MEANS OF SEPARATING AND UTILISING THE PHOSPHORIC ACID FROM IRON ORES.

By JULIUS JACOBI,
Director of the Smelting Works at Kladno, Bohemia.

The method of working proposed by the inventor, consists in changing the insoluble basic phosphates contained in the ores into soluble acid phosphates, and the separation of the soluble phosphates, by a simple process of leaching.

In order to attain this result, the ore is treated with a compound of sulphur and oxygen usually most advantageously and cheaply with sulphurous acid in the gaseous state or in solution, for which purpose a very dense ore must naturally be pulverised, a pyritous ore or one containing carbonic acid must be well roasted by well-known methods, while a porous ore which allows the penetration of the liquid into the pores, can be used in pieces of moderate size. The ore thus prepared is placed in receivers the size and shape of which must be dependent on various conditions, and water impregnated with sulphurous acid is turned upon it, or the sulphurous acid gas is conducted at once to the ore, while a stream of cold water is turned upon it at the same time, so that the absorption of the sulphurous acid into the ore takes place through the medium of the water.

The latter would be especially good with porous ores, since the gas readily enters the pores, and its operation would therefore be more rapid.

Moreover, as a simpler and more rational mode of working, the sulphurous acid might be forced under pressure into the solution.

The solution after this operation should stand over the ore until no further reaction takes place, and until the greater part of the phosphoric compounds has passed into solution. It is very important to observe this carefully, and not to allow the reaction to continue too long, since otherwise phosphates may be again precipitated. The solution is then drawn off, and replaced by water, which will remove the salts rendered soluble but not previously removed. This washing is continued as long as phosphoric acid may be detected in the wash water. If phosphoric acid still remains in the ores, the same process may be gone through with once or several times more, according to the degree of purity required for the ore. It is evident that the duration of the operation must be regulated by the amount of phosphate in the ore, and its porosity. After the last treatment with acid, the ore must be well washed with water, to remove all traces of the acid.

The water remaining after each treatment, which contains the phosphorus compounds, is collected and heated

directly by a naked fire, or by passing steam pipes through it, in order to drive off the sulphurous acid, by which means a portion of the phosphates will be precipitated. The sulphurous acid thus driven off may be allowed to escape into the air, or if one is economically inclined it may be again united with water and used over again. The liquid, in which by heating a portion of the phosphorus compounds have already been precipitated, is then treated with burnt lime, and allowed to stand until the whole precipitate, which contains all the precipitable substances, has settled to the bottom of the tank. The addition of lime is of course only necessary when, by heating the liquid to drive off the sulphurous acid, all the phosphorus compounds are not precipitated, which is the case with many ores. Thereupon the clear liquid is to be drawn off, and the deposit, when it has attained the right consistency, removed. This is now, on account its containing phosphoric acid, a very valuable product for agriculture and the arts, and may be sold for direct application in agriculture, or for further working up. In many cases the proceeds from this sale will cover a large part of the expense of treatment. The preparation of the sulphurous acid is effected by some known method from sulphur, pyrites (where these are to be obtained cheaply) or from other similar substances.

The purified ore should be taken from the receivers and treated in shaft furnaces, when a good pig-iron will be obtained. If the ore has been previously pulverised it is well, before charging it into the furnace, to make it into bricks by the use of lime or some other cementing material.

By the removal of the phosphorus compounds the iron ore becomes somewhat richer in iron, as well as purer.—*Bayerisches Industrie und Gewerbeblatt.*

ON THE RESULTS OF DISINFECTION ON THE BATTLE-FIELDS IN FRANCE.

Report of C. JUNGHAUS.

In the month of October, commissioned by the Directory of the German Chemical Society at Berlin, I visited the environs of Metz, and was during most of the time actively engaged in the work of disinfection upon the battle-fields of Saint Privat, Amanvilles, and Bernéville. The means at command for the accomplishment of this work were chloride of lime, manganese lye (the acid residuum from the manufacture of chlorine gas), and carbolic acid in large quantities. Besides these, green vitriol and a disinfecting powder, which contained carbolic and green vitriol, were also on hand in smaller quantity.

The trench graves (*massengrabern*) on these fields were very numerous and near together, often concealing from one to two hundred bodies apiece. For these, and for the great number of horse carcasses lying buried almost everywhere, it was necessary to obtain, with the means at our disposal, a disinfection which should be not only immediate, but effectual for a long time. For this purpose, a prompt and copious flow of chlorine gas was procured from chloride of lime and manganese lye, and applied in the following manner to the large burial mounds. Upon each of these mounds, on which the earth lay to a depth of from 1 to 3 feet, a long trough was dug with a spade; into this the rich manganese lye was allowed to run. Chloride of lime in large quantities, sometimes reaching 100 lbs., was then thrown in, the channel covered with earth, and the mound strewn widely with chloride of lime. Earth was then thrown over all, and the hill heightened where necessary. After ten or twelve days, as long a time as it was possible to extend the observations, a distinct chlorine smell was perceptible at a distance of about one hundred paces from the place where several of the burial mounds so treated lay close together. This smell was more particularly noticeable after a hard rain, which brought the chemicals together in solution.

It was fully proven that manganese lye by itself is a powerful disinfectant. Several horse carcasses which, like all the rest, were much further gone in decomposition than the human bodies that we encountered, and which emitted a very great stench, were abundantly sprinkled with manganese lye alone, for on that day we were not able to add any chloride of lime. After several days, when we returned to work again upon this place, all stench had disappeared. It should be mentioned that the lye was used undiluted, just as obtained from the Union Chemical Works, at Mannheim.

The carbolic acid, which was a better quality of the crude acid of commerce, said to contain 60 per cent of pure acid, was also applied to the horse carcasses. This application was continued as long as the supply would permit, in connection with green vitriol and the disinfecting powder, Those carcases which lay mostly uncovered, or on which earth had been thrown as they lay, were, as far as possible, sprinkled directly with carbolic acid. Either green vitriol or the disinfecting powder was then put on, and the earth thrown up over the whole. Certainly no immediate *disinfection* could be obtained with the carbolic acid, highly prized though it be for retarding *putrefaction*. This was all the more true when the green vitriol and disinfecting powder were applied along with it. The stench in these cases was finally dispelled by a single application of chloride of lime, so that no renewal could be perceived. These points were especially observed in the case of a large number of carcasses lying in a stable belonging to the farm-house of Champênois, at Bernéville, which had been destroyed by fire. It was not possible to cover them with earth. It was in its application as an antiseptic to these great masses of flesh, which in all probability even now are no better interred, that carbolic acid was most constantly useful.

From these observations and experiences obtained on the spot, I think I may draw the conclusion that it is advantageous, in cases of this kind, to saturate thoroughly, as early as possible, the earth overlying the graves with salt solutions that have the power of absorbing or destroying gases. Green vitriol and manganese lye possess, in addition to their well-known efficacy, the advantage of cheap production. If foul gases have already escaped, the immediate application of chloride of lime is the most convenient means for their destruction.

Bromine, just as energetically efficacious as chlorine, has already been advantageously applied to the disinfection of foul-smelling waters. It is too volatile to use on the graves of battle-fields, besides being difficult of application.

Horse carcasses, which unfortunately are always badly interred, should be at once impregnated with carbolic acid. For this purpose it is sufficient to sprinkle the acid upon the ears and abdominal cavity, and upon the immediate surroundings of these parts.

A careful burial, however, without too much crowding, is undoubtedly the most certain way of preventing subsequent evil consequences, even if it require the expenditure of a great amount of time and labour. A very great deal has been done in time of war by the authorities and by private individuals from motives both humane and selfish. A proper burial of the victims of the war is, however, yet to be secured.—*Dingler's Polytechnisches Journal.*

Oldham School of Science.—A laboratory for the use of students in practical inorganic chemistry having been opened at the Oldham School of Science and Art, twenty-one *artizan* students presented themselves for examination by the Department on the 3rd of May, and nineteen of them have passed.

NOTES FROM THE INTERNATIONAL EXHIBITION OF 1872.

In the absence of an Official Report upon the Recent Scientific Inventions and New Discoveries exhibited at South Kensington this year, we present to our readers a short account of the principal features of this department of the Exhibition. Entering from Exhibition Road, we are at once within the precincts of that curious collection, the Indian Court. This court has a relative interest for the scientific visitor, because as here represented the majority are the results of hand-labour, while the remainder of the building is devoted to the products chiefly of machinery, or to the machinery itself and its construction. The Indian contributor presents to us those elaborately carved caskets, the delicate filagree work in gold and silver, for which he has been justly celebrated through so many ages. There is, too, a case of native musical instruments, and these, though perfectly beyond our comprehension in other respects, show that there has been much careful thought expended upon the construction of their gourd-shaped resonant chambers. At the end of the Indian Court is the entrance to the Stationery Department, and here are exhibited the process of Heliotype Printing by the Heliotype Company and the Woodbury Process by the Permanent Printing Company. Mr. S. H. Cowell has here a process, termed Anastatic Printing, which appears suited to many useful applications. The design drawn upon ordinary paper with the prepared ink is transferred from the paper to a metal plate, from which an indefinite number of copies can be produced, the invention being intended to supersede lithography. Appropriately Messrs. Parkins and Gotto exhibit on the opposite side of the room a Lithographic Printing Machine by Mr. S. Barrett, as well as machines for cutting and stamping paper. In the next room are exhibits illustrative of the process of paper-making, but to the chemist there is nothing of interest, excepting the Pulse Pump for laboratory use of M. Mendelejeff, to which is, however, appended very little information, a remark equally applicable to an interesting Thermo-Electric apparatus in this room. Passing a long array of cases containing some elaborate specimens of Valentines, writing-cabinets, stationery with every variety of device, &c., a case containing specimens of half- and whole-stuffs for paper-making, we enter a gallery lined with newspapers and periodicals in all languages, from Greek to Gaelic, from Hungarian to the equally unpronounceable Welsh. This corridor conducts to the room devoted to scientific inventions, and we are immediately before the table at which the attendant explains the uses of the Fire-proof Starch, and shows how readily unprepared muslin may be ignited, while muslin starched with the Fire-proof Starch only smoulders. The starch can be supplied at 8d. per lb., certainly cheap enough for use where there is more than ordinary risk, as in ball-dresses or bed-room hangings. The colour, Messrs. D. Nicoll and Co. state, is the same as with other good kinds of starch, and the fire-proof starch contains no ingredient of any kind unpleasant or prejudicial to health and comfort. Farther in the room we have Colonel H. Stuart Wortley's Results of New Dry Photographic Process for working by the use of collodio-bromide of silver without a silver-bath. The plates are very clearly defined, and we wish they were more numerous. Near at hand is a Foul Air Purifier for sewers, exhibited by Mr. Ludstone, and consisting of a ventilating lantern containing charcoal or the disinfectant. With M. Leon Delperdange's Cylinder for conducting Telegraph Wires Underground there is exhibited a Telegraphic Apparatus, founded upon Morse's system, the invention of M. De Torville. This instrument is in use upon some Russian lines, and is very simple in construction, the whole of the apparatus being arranged upon a small table, in the interior of which is some mechanism for winding up and drawing forward the paper slip as it is printed. On the wall are diagrams in which Dr. Karl Ticinsky propounds the Quadrature of the Circle, a matter not very interesting to the visitor. Sir Joseph Whitworth and Co. exhibit models of a Breech-loading Naval Gun and a Breech-loading Field Gun and Carriage, as well as a Six-pounder Breech-loading Rifled Gun and Carriage made of Sir Joseph Whitworth's Patent Compressed Metal. Messrs. Siemens Brothers and Lœffler exhibit Dr. Siemens's Apparatus for Working Pneumatic Despatch Tubes, on the continuous current system, as established for the transmission of postal telegrams between the West Srtand and Central Telegraph Stations, together with an Exhauster or steam-jet arrangement for drawing the air through the tubes. Dr. Siemens also exhibits his Deep Sea Photometer, for comparing the intensities of light at different depths of water. The apparatus was very successfully used on board H.M.S. "Shearwater," in August, 1871, for comparing the intensities of light at different depths of the Straits of Gibraltar. Further in the centre of the room is a valuable collection of acoustic apparatus by Messrs. Lefêbre, of the Hague, but the utility of the invention cannot be made apparent without diagrams. Lieutenant-Colonel Clarke, C.B., R.E., has a model of Three-legged Shears admirably adapted for a wharf too narrow to admit of the back leg traversing horizontally in the usual manner. Mr. Bessemer exhibits a very complete series of sectional models illustrating the Bessemer principle of constructing Continuous Low-Pressure Ordnance; while Major Palliser's contribution of a Service Muzzle-loading Sixty-four-pounder Rifled Gun, converted on the Palliser principle from a smooth bore thirty-two-pounder gun, and having fired 2300 rounds, may be considered to complete the artillery exhibits, together with the specimens of Gunpowder, recently tried by the Committee on Explosives, and a Crusher Gauge for directly determining the pressure of fired gunpowder, both by Captain W. H. Noble, R.A. Distributed through the room are models of the Newport Patent Puddling Furnace, exhibited by Mr. Jeremiah Head; a Patent Hot-Blast Fire-Brick Stove, exhibited by Mr. T. Whitwell; a Kiln for burning bricks, lime, cement, &c., by Mr. A. Batchelar; and Mr. Danks's Patent Puddling Furnace. Messrs. Lynch and Co. exhibit a knobbed Poison Bottle to prevent use of poison by mistake in a dark or dimly-lighted room.

The actual results of chemical processes are very scantily represented, being confined chiefly to the preparation of the pulp for paper making. Mr. F. B. Houghton exhibits a series of four bottles illustrative of the manufacture of pulp from wood, in reference to recovering the alkali without evaporation or calcination. The liquor in which the wood has been boiled to disintegrate the fibre is treated for the coagulation of the resin, the remanent liquor being treated as if it were new soda-ash, and the resin as a valuable by-product. Permanganate of soda is preferred as a bleaching agent by the inventor. There are also drawings of Apparatus for Recovering Soda used in Preparing Fibre for Paper making, which obviously we cannot copy here; they are exhibited by Messrs. W. W. Ladelle and A. G. Southby. Messrs. B. Donkin and Co. exhibit an enormous Spherical Boiler for boiling and washing rags, hemp, straw, &c., for paper manufacture. There are two Non-conducting Cements for covering boilers and steam-pipes, exhibited by Messrs. Leroy and Co., and by Messrs. Fox, Head, and Co. Almost at the end of the room is the model of a house or shed constructed of waterproof paper, and exhibited by The Universal Paint and Waterproof Fibre Company, the paper being rendered waterproof by the Patent Cupro-Ammonium Process, of which the company are the licencees. Cupro-ammonium is, we believe, an arbitrary term, the material being prepared by the immersion of copper turnings in concentrated liquid ammonia, with access of air. After some time the ammonia is stated to acquire a deep blue colour, and peculiar agglutinising or solvent properties. Paper or almost any

fibrous substance dipped into this liquid becomes so far reduced, that by being pressed upon itself, or upon another sheet similarly prepared, a solid mass of any required thickness can be obtained. Copper-oxide dissolved in ammonia is said not to have the same solvent action. Paper may thus be rendered waterproof, being afterwards corrugated for roofing purposes, &c., at an increase of 40 per cent upon the original cost. Mr. H. Deacon contributes drawings of his Method of Obtaining Chlorine. The process consists in passing a heated mixture of air and hydrochloric acid over sulphate of copper, or over pieces of pumice or brick saturated with a solution of this salt. The velocity with which the mixed gases pass over the surface of the active material causes considerable variation in the comparative amount of chlorine produced.

The electrical exhibits of this year are by no means numerous. Leaving the room devoted particularly to scientific inventions, and which we have almost exhausted, we meet with the Electric Motor Clock of Messrs. Cooke and Son, of York. This clock has now been driving the clocks in the several rooms of the Exhibition for two years; to those who know the difficulties of electric horology a sufficient recommendation. In the French Court is exhibited by Messrs. Moseley and Son a novel form of Electric Clock, in which the electric current is called into action only when the oscillations of the pendulum are decreasing; by this means the consumption of materials in the electro-motive element is reduced to a minimum, and the regularity in keeping time ensured for a longer period.

The first actual application of electricity to the uses of organ construction was made by Mr. Barker, of Paris; and Messrs. Bryceson Brothers and Co., seeing the great advantages which the system offered, introduced it into England in the organ built by them for Her Majesty's Opera in 1868. In churches, halls, &c., many positions can be utilised by this system that were formerly utterly impracticable. The organ exhibited in Room 13 is played by electricity, the organist literally telegraphing his manipulations through a cable. An electric current is completed round its corresponding magnet by pressing a key, and the armature being attracted causes the pallet to open and admit wind to the pipes. By an automatic arrangement the electrodes of the four cells of the single fluid battery employed are withdrawn from the exciting fluid when the wind is out of the organ, so that all waste of chemicals is suspended. We must, to be fair, acknowledge the superior workmanship of the ordinary manual organ of Messrs. Jones, whose instrument has met with unanimous commendation from the musical critics; and we cannot leave this portion of the exhibits without noticing the elaborately inlaid pianofortes of Messrs. Hopkinson and of Messrs. Erard. Messrs. Erard's instrument is exhibited in the French Court, and its interest is due to beauty alone; but the pianofortes of Messrs. Hopkinson embody an application of iron in the construction of what is termed "the back" of the instrument, decreasing the liability to get out of tune, especially in hot climates. This firm also exhibits some smaller instruments of extreme brilliancy and fullness of tone, to which the musical critics have accorded high commendation.

The exhibits offering the greatest attraction to visitors are undoubtedly the various newspaper presses. The "arte and mysterie" of printing has had its special interest for all ages of its use; and there are two machines in the present Exhibition, types of the wonderfully rapid progress that has been made since 1474. We allude to the Marinoni printing press, turning off its 12,000 copies of the *Echo* hourly; and to the "Walter Press," which derives its name from the enterprise and perseverance of its inventor, Mr. Walter, M.P. By this machine, the *Times*, *The Mail*—a tri-weekly reprint of the *Times*, and the *Scotsman* are now supplied to the public, with very little manual labour. The Walter Press is what is termed a "perfecting" machine, printing both sides of the sheet at one operation. The details of the machine are very simple. At one end of the framework of the press is a roll of paper several miles in length. This paper is led from the roll into a series of small cylinders, where it is damped. It is then brought between the first and second of four cylinders, supported above each other perpendicularly in a powerful framework. The highest of these cylinders is encircled by the stereotype casts from four pages of type, and the lowest cylinder is similarly surrounded by the casts of the type of the remaining four pages of the newspaper. Between the highest pair of rollers one side of the paper is printed; then passing backwards between the second and third cylinders, it is again drawn forward between the third and fourth cylinders, receiving an impression on the opposite side from the latter cylinder. The printed paper passes to the cutting cylinders, where it is cut into sheets. The manual labour required is therefore limited to the attendance upon the apparatus distributing the printed sheets, since the machine is self-feeding from the continuous roll of paper. The paper passes through the machine at the rate of nearly 1000 feet per minute, so that a roll of paper four miles long (as supplied by the paper mill), is printed and taken off in less than twenty-five minutes. The matrix of the type is taken from the whole page at one operation in *papier maché*, being rapidly dried upon heated surfaces. Into this mould stereotype metal is poured, the entire operation being completed in thirteen minutes. This marvellous celerity has been attained by careful investigation as to the best alloy for the stereotype metal, which, at the same time, must be readily fusible and sufficiently durable to stand the wear of many thousand impressions.

We should much like to notice the stoneware and other exhibits, but from a scientific point of view there is nothing further that calls for the extension of our description last year.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

Red Colouring Substances.—Madder.

This well-known tinctorial substance may still be considered as the most important of all the dye-stuffs employed by calico-printers, owing to the brilliancy of the colours, and their permanence under the action of light and soap, and the wear and tear which fabrics so dyed can sustain, as well as on account of the variety of shade and colour that can be obtained; one dyeing operation being sufficient to produce pinks, reds, purples, violets, puce, and black; and, notwithstanding the competition that madder colours have met with of late years from aniline dyes, I believe the quantity of madder consumed in England is quite as great at the present day as ever it was.

The employment of madder-root as a dye dates from the most ancient times, as is proved by the Egyptians using madder-dyed fabrics to wrap round their mummies. The Greeks and Romans were acquainted with it under the names of *Erythrodanon* and *Rubia*, and their modes of fixing it on cotton fabrics were the same as those now employed, namely, aluminous salts for producing reds, and salts of iron for purples and blacks.

The plant which produces madder is an herbaceous one, and is called *Rubia tinctorium*. It bears a yellow flower, and a dark red berry fruit. The red colouring matter exists almost entirely in the cortical part of the root, little or no colour being found either in the epidermis or in the ligneous or centre part of the root. M. Decaisne

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

and M. Edouard Kœchlin have shown that the colouring matter in the fresh root is yellow, and becomes red under the oxidising influence of the atmosphere. The same process goes on, to a certain extent, in the roots of the plant when they are allowed to remain several years in the ground, especially in chalk formations. In France, the roots are allowed to remain in the ground two or three years; in Turkey and the East, from five to seven. In the latter countries and in Naples they are dried in the open air, but in Holland and France stoves are employed for this purpose. Naples and Turkey madders are imported in the root, and are known in commerce as Naples and Turkey roots, while those from France and Holland are ground, and sold under the name of French and Dutch madder.

One hundred parts of fresh root yield, on perfect desiccation, twenty parts of dried substance. The roots as imported always contain 16 or 18 per cent of water; the fresh roots, therefore, give 24 or 25 per cent of commercial madder. Dutch and Alsatian madder, after being ground, is stored in large casks, and kept for two or three years, when the colouring matter is developed, and its tinctorial power is much increased: if, however, it is kept five or six years, further changes ensue, and its value seriously decreases. French Avignon madder can be employed at once, although the quality is much improved by keeping it one or two years. The best Avignon madders are grown on lime formations. The roots that have a red colour are called *palus*, and those that are pink *rosées*, the former being considered the finest. The value of these madders is in ratio to the fineness of their powder, the finer powder containing the most colouring matter.

The nature of the chemical changes occurring in madder during the time it is stored, and which so much improves its commercial value, was entirely unknown until the elaborate and interesting researches of Dr. Ed. Schunck, F.R.S., published in the year 1851. He succeeded in isolating a peculiar ferment called *Erythrozym*, which possesses the property of decomposing a substance called by him *Rubian*. Rubian may be considered as a glucoside (this name being given by chemists to compounds of sugar with other organic principles), and is decomposed by erythrozym into a peculiar sugar and *alizarine*. Whether there are in the *Rubia*-root several glucosides which unfold themselves respectively into sugar and one of the colour-giving principles, or there is only one glucoside, and its colour-giving principle—as it is liberated—gets successively oxidised into alizarine, purpurine, &c., is not yet satisfactorily determined. Still this valuable discovery of Dr. Schunck has thrown much light on the subject, and has led to several important commercial improvements, to which I shall call your attention as I proceed. One hundred parts of dried madder-root consist of—

Soluble in cold water	55 parts.
Soluble in boiling water, and which contains the greater part of the colour-giving principles	3 ,,
Soluble in alcohol	1·5 ,,
Fibrous matter	40·85 ,,

I shall make no remark on the gum, mucilage, pectine, pectic acid, and pectates, which the *Rubia*-root contains, but state that the water extract contains also the yellow colouring-matter discovered by Kuhlman in 1824, and called by him *Xanthine*; but this colour has never received any commercial application, from its want of brilliancy. Water also dissolves another colouring principle, called *Chlorogenine*, which is decomposed by weak acids into sugar and a brownish-green matter. Both these colouring substances are sources of annoyance to the calico-printer, as they render very difficult the obtaining of pure whites in printed goods, and they dim the brilliancy of the shades produced by the combination of alizarine and purpurine with the mordants. Further, the cold water dissolves the sugar contained in the root, and on the Continent it is transformed into alcohol. The yield of alcohol varies with the nature of the root, and ranges between 7 and 10 lbs. per cwt. of root. This fact shows that there is from 10 to 15 per cent of sugar in the root.

Messrs. Julian and Roquet have based on the above facts a commercial process for preparing a purified madder, which they call *Fleurs de garance*, of which several million pounds are now manufactured in France per annum. It not only yields brighter colours than the original madder, but, as it does not soil the white parts of prints, its use saves the printer much soap and labour. To prepare the *fleurs de garance* the madder is mixed with 8 or 10 parts of water, and left for three or four days at a temperature of 75° to 80° F., when fermentation ensues, transforming the sugar of the root into alcohol, which is collected. The madder, deprived of all soluble substances, is dried, and ready for use. A hundred parts of madder yield from 55 to 60 per cent of *fleurs de garance*. I may state, *en passant*, that the injury which Dutch and Alsace madders sustain when kept too long in casks is doubtless owing to the fact that, after the erythrozymic fermentation is completed, an alcoholic and lactic one sets in, which acts injuriously on the colour-giving principles.

I now proceed to lay before you the outlines of two interesting processes for extracting commercially the two useful colour-giving principles, *alizarine* and *purpurine*.

The first is due to M. Leitenberger, and is based on the fact that purpurine is soluble in water at 130° F., whilst alizarine only dissolves at 170° F. He mixes madder with water, and heats the whole gradually, by means of a jet of steam, at 130°, at which temperature it is maintained for some time. The liquor is then run off and filtered. To the clear solution, lime—or, still better, baryta—is added, when a lake precipitates. This is washed and mixed with hydrochloric acid. The purpurine thus liberated is thrown on a filter, washed, and is ready for use. The madder remaining from the above operation is dried and heated in close vessels with wood spirit, which dissolves the alizarine. This extract, thus obtained, after being concentrated by distillation, is ready for use. A hundred parts of root yield from 2 to 3 per cent of purpurine, and 4 or 4½ per cent of alizarine.

The second process, that of Professor Emile Kopp, is based on another discovery of Dr. Schunck, namely, that weak acids act upon rubian in the same manner as erythrozym, unfolding it into sugar and alizarine. M. Kopp found, some years since, that sulphurous acid dissolved the glucosides of purpurine and alizarine, and applied this observation as follows:—600 lbs. of Alsace madder are macerated for 12 or 15 hours with 800 gallons of a weak solution of sulphurous acid, to which is added one-thousandth part of hydrochloric acid, to neutralise the earthy carbonates existing in the root. This operation is repeated three times. To the liquors 3 per cent of sulphuric acid are added, and the whole heated to a temperature not exceeding 140° F., when red-coloured flakes separate and gradually deposit, which, when washed and dried, are commercial purpurine, The liquor is then carried to the boil for a couple of hours, and allowed to cool, when a dark green powder is found deposited in the vessels, which, when washed and dried, is commercial alizarine.

This process has been carried out by Messrs. Schaaffer and Lauth for many years, and no doubt yields a larger amount of colour-giving principle than M. Leitenberger's method, the glucosides being doubtless more completely decomposed by the acids than by water alone. It has the further advantage of obtaining the colouring matters free at once, which have only to be washed to be ready for use.

The dyeing power of the alizarine thus obtained is equal to 40 times its weight of madder, or 10 times that of garancine. These colouring substances, except green alizarine, are not substituted for madder in the dyebeck,

but are printed on the cloth and steamed, as will be described further on.

M. Kopp found that his green alizarine is a mixture of alizarine with chlorogenine, and that this latter body can be separated by treating the mixture with a light oil of tar, having a boiling-point of 300°, which dissolves the chlorogenine. Alizarine is employed in the production of rich purples, whilst purpurine is used for reds and pinks.

Before describing pure alizarine and purpurine, I may state as a fact very interesting, although of no commercial value, that if superheated steam be passed over a preparation of madder known as garancine, pure alizarine is volatilised, and may be easily collected.

Pure crystallised alizarine was discovered, in 1824, by MM. Robiquet and Colin, by treating madder with strong sulphuric acid, when they produced a black mass, which they called *Charbon de garance*, and which, on being heated at a moderate temperature, yielded crystals of alizarine.

In 1851, Dr. Schunck succeeded in isolating from madder a substance to which he gave the name of *Rubian*. This he effected by filtering a hot decoction of madder on pure animal black, which is washed with cold water to remove chlorogenine. The washed charcoal is boiled repeatedly with alcohol, and the alcohol solution evaporated to dryness. The dry mass is dissolved in water, and acetate of lead added, which gives rise to a precipitate. This precipitate, when acted on by sulphuretted hydrogen, gives pure rubian in solution. When rubian is acted on, either by erythrozym or weak acids, it is decomposed, yielding, according to Dr. Schunck's paper, alizarine and water; according to M. Schützenberger, alizarine and glucose, or grape sugar.

Pure alizarine sublimes, at a temperature of 460° F., into pale orange prismatic crystals. When slowly crystallised from an ethereal solution, it forms a hydrate, containing two equivalents of water, which crystallises in lustrous scales. Cold water dissolves a mere trace of alizarine, but its solvent power increases as the temperature is raised, as may be seen from the following figures:—

At 212°	100 parts of water dissolve	..	..	0·034
At 490°	,,	,,	.. ..	0·820
At 480°	,.	,,	.. ..	3·160

Alizarine is freely soluble in alcohol, ether, wood spirit, benzole, turpentine, sulphuret of carbon, and glycerine. It is soluble without decomposition in sulphuric acid, even at a temperature of 400° F., and is thrown down unchanged when large quantities of water are added. It is soluble in a warm solution of alum, but insoluble in a cold one. It has been assigned different formula by different chemists, the two most generally adopted being that of Dr. Schunck, $C_{14}H_{10}O_4$, and that of Wolf and Strecker, $C_{20}H_{12}O_6$. Alizarine gives a purple colour with a weak solution of caustic alkali, which undergoes no change by the action of air. It yields, with alumina fixed in fabrics, a variety of red and pink shades; with oxide of iron it gives purples and blacks; and, with a mixture of these two oxides, chocolates.

I shall now call your attention to one of the most interesting and important discoveries of chemistry, as applied to manufactures, which have been made of late years, namely, the artificial production of this most important colour-giving principle, alizarine, or of a substance which —if not identical—has great similarity to it. Messrs. Graebe and Liebermann, and Mr. Perkin, believe in the identity of the artificial product with the natural one. But this is denied by M. Alfraise, on the grounds, first, that the formula given by Messrs. Graebe and Liebermann does not agree with that given by Dr. Schunck, as is shown by the following figures:—

Schunck.	Graebe and Liebermann.
$C_{14}H_{10}O_4$	$C_{14}H_8O_4$.

Secondly, that the artificial alizarine does not give the same coloured sublimate as the natural alizarine; and thirdly, that if both these substances are acted on by nitric acid, natural alizarine is converted into phthalic acid, whilst the artificial alizarine, which he calls alizapurine, yields a large quantity of a nitro-compound having an intensely bitter taste, mixed with only a mere trace of phthalic acid. These observations of M. Alfraise have been confirmed by M. Kopp. That the commercial artificial alizarine is not identical with a natural alizarine is rendered still more certain by the researches of Dr. Schunck, who, on examining a sample obtained from Mr. Perkin, found it to contain a large quantity of a compound crystallising in yellow, silky needles, anthraflavic acid, and which he obtained by treating Mr. Perkin's product with alcohol. On treating the acid with fuming nitric acid he obtained a nitro-compound, the potash salt of which he describes as resembling picrate of potash. This is doubtless the bitter principle which Alfraise obtained, but did not study. Dr. Schunck gives the formula of anthraflavic acid as $C_{15}H_{12}O_4$, and considers it homologous to alizarine, one equivalent of its hydrogen being replaced by methyl. Messrs. Graebe and Liebermann, and Mr. Perkin, found their opinion as to the identity of the two alizarines on the fact that they give the same absorption-bands on being submitted to Professor Stokes's spectrum test.

Artificial alizarine was first made in 1869, by Messrs. Graebe and Liebermann. The substance from which they obtain it is *anthracene*, a body discovered by Professor Anderson, of Glasgow. Anthracene is one of the last products passing over in the dry distillation of coal-tar, and is found most abundantly in the 10 or 15 per cent which comes over from the temperature where soft pitch is formed and that where hard pitch is produced. The quantity of anthracene in coal-tar varies greatly; it is most abundant in the tars obtained from those coals which yield most naphtha. The South Staffordshire coals give the largest quantity, whilst the Newcastle coals give very little. Its extraction can only be carried on with advantage in cold weather, as it becomes very soluble on a slight rise of temperature in the oily homologues which accompany it. At a temperature of about 40° the distillate above described is semi-fluid; it is placed in a hydro-extractor, and the oily fluid separates from the solid matter, which is then submitted to cold and hot pressure. The cake thus formed is pulverised and carefully washed with petroleum spirit, having a boiling-point of about 180°, which leaves anthracene moderately pure. This powder, dissolved in alcohol and crystallised, yields anthracene in nearly white scaly crystals, or in a fit state for the manufacture of artificial alizarine.

Messrs. Graebe and Liebermann oxidised the anthracene ($C_{14}H_{10}$) by nitric acid, into anthrachinon ($C_{14}H_8O_2$), this being again converted into bibrom-anthrachinon ($C_{14}H_6Br_2O_2$), which, by fusion with potash, is changed into alizarine ($C_{14}H_8O_4$). There are three patents published, and a process, the details of which are kept secret. It is curious to notice that the patent taken out by the above-named gentlemen and M. Caro is dated June 25th, 1870, while Mr. Perkin entered his on the day following, in which nearly the same processes are described, merely employing different oxidising agents.

The following is an outline of one of the processes detailed in the specification of MM. Caro, Graebe, and Liebermann:—1 part of anthracene is heated with 4 parts of sulphuric acid, of sp. gr. 1·845, for 3 or 4 hours, to a temperature of 212° F., and then for 1 hour at 300°. The mixture is allowed to cool, and to it is added water equal to 3 times the weight of anthracene taken, and manganese equal to 4 times that weight. The whole is boiled for 3 hours, and a milk of lime is then added, which gives rise to a deposit, consisting of the excess of lime and manganese used, and protoxide of manganese, while there remains in solution a double sulphate of anthrachinon and lime. This solution is now acted on by car-

bonate of soda in slight excess, carbonate of lime separates, and the salt of soda thus produced is evaporated to dryness. To this solid mass is then added 2 or 3 parts of caustic potash or soda and a small quantity of water, and the whole heated under pressure, in suitable vessels, at a temperature of 350° to 500° for 1 hour, when the anthrachinon is further oxidised, and converted into alizarine. This anthracene, $C_{14}H_{10}$, gives anthrachinon, $C_{14}H_8O_2$, and this alizarine, $C_{14}H_8O_4$. The alkaline mass, on cooling, is dissolved in water, and sulphuric or acetic acid added in slight excess, when an orange-yellow flocculent substance precipitates, which, when properly washed and dried, is artificial alizarine.

The second colour-giving principle of madder, to which I have referred several times already, is called purpurine, and was also discovered by MM. Robiquet and Colin, in 1828. Although in commerce it is sold as a red powder, as has been mentioned above, still, by heating at a temperature of 480° F., it can be obtained in the form of feathery crystals, of an orange-red colour. It is more soluble in water than alizarine, especially at a temperature of 140° F., and is also soluble in the menstrua already mentioned under alizarine. Further, it gives a red colour with caustic alkali, instead of purple as alizarine. It is soluble in a cold solution of alum, while alizarine is not. When fixed on fabrics, its colours do not stand exposure to light as well as those of alizarine.

Professor Stokes, of Cambridge, has found a most elegant method of discovering and characterising mere traces of these colouring principles. So delicate is the test, that the colouring matter on 1 square inch of dyed fabric is sufficient to obtain the results. He treats the fabric with a solution of carbonate of soda, which dissolves the colouring matter. The solution is then introduced into a small tube, which is placed before a slit in the shutter of a dark room. The light which passes through is decomposed by a prism, when a spectrum is produced. The operator will observe that, when purpurine is taken, there are principally two black bands formed by the absorption of light in the green part of the spectrum, having between them a band of green light, whilst alizarine exhibits, on analysis, a band of absorption in the yellow, and another narrower one between the red and the orange.

Professor Schützenberger, by treating commercial purpurine successively with alcohol and benzine, unfolded it into four different substances, to which he assigns the following formulæ:—

Alizarine	$C_{20}H_{12}O_6$.
1. Purpuroxanthine	$C_{20}H_{12}O_6$, or $C_{20}H_{14}O_6$.
2. Purpurine	$C_{20}H_{12}O_7$, or oxy-alizarine.
3. Orange matter ..	$C_{20}H_{16}O_9$, or hydrate of purpurine.
4. Pseudopurpurine	$C_{20}H_{12}O_9$, or oxy-purpurine.

(To be continued).

CORRESPONDENCE.

ERNEST THEOPHRON CHAPMAN.

To the Editor of the Chemical News.

SIR,—Mr. E. T. Chapman, whose name is so well known to your readers and to the whole scientific world, was killed by an explosion in his laboratory at Ruebeland, in the Harz, on the 25th of June last. He appears to have been engaged of late in the manufacture of nitrate of methyl (called by the correspondent "salpetersäure methyl-æther"). Mr. Chapman, in one of his letters, describes the substance with which he was working as useful for blasting purposes, but remarkably difficult to explode, and indeed capable of being burnt like alcohol, without explosion.

The "bomb-proof" building in which Mr. Chapman and three workmen were engaged was blown up with a terrific noise. All in the building were instantly killed. The surrounding buildings were injured, and ten other people were dangerously wounded. Nothing of course is known of the immediate cause of the explosion. Surely our experience is now sufficient for us to distrust explosives containing hydrogen and nitrogen oxides. And surely a "bomb-proof" building is the worst kind of building for storing explosives of any kind.

All who have the progress of chemistry sincerely at heart, will grieve that this man of great performance and boundless promise has been thus removed from us. Though Mr. Chapman was only twenty-six years of age, few living chemists have contributed more abundantly to organic chemistry, and his originality was as great as his skill and devotion.

Mr. Chapman had many opponents. No one worth his salt has not. But I do not think that there is one among even these who will not grieve at his death. A kinder, a gentler, a more generous heart never beat than the one which is now at rest beneath the pine woods of the Harz.—I am, &c.,

FREDERICK GUTHRIE.

PROPOSED ASSOCIATION OF MANUFACTURING CHEMISTS.

To the Editor of the Chemical News.

SIR,—I was very much interested in the letter of your correspondent "Frank" respecting the formation of an Association of Manufacturing Chemists. He will probably be gratified to hear, that in at least one of the great centres of chemical industry, the nucleus of such an association already exists. I refer to the "Tyne Social Chemical Society," a private association of the managers and chemists of nearly all the principal chemical works of Newcastle-on-Tyne and its neighbourhood. It has been established for the purpose of promoting a scientific and friendly intercourse among the practical chemists of the district. This is effected—first, by the reading and discussion of papers on manufacturing subjects; secondly, by conversations which are started on questions of practice arising from time to time, and which are frequently the means of eliciting the most valuable information.

We meet once a month in a very informal way, and except during the reading and discussion of the papers, our proceedings are carried on in little groups of twos and threes, discussing the last new thing in chlorine, the progress of A.'s new chambers, or B.'s break down, or C.'s new pumping engine.

It is surprising what an amount of solid information is exchanged at these meetings, the fact being that since almost every manufacture of the district is represented by one or more of its managers, you can get information upon any subject you want. Of course there is a certain etiquette observed in any process which is considered private, but these processes are so few that we have had but little difficulty on this head. We have discussed the manufacture of oil of vitriol in every minute detail, the Weldon process, the manufacture of soda-ash, kelp, ammonia, the economy of fuel, construction of pumps, boilers, and engines, incrustations, and a hundred other subjects, upon every one of which some one or more members could give the most useful practical information arising out of his own experience.

If the managers of other districts would form associations of this kind, I can assure them from my own experience and of the members of our society, that an incalculable amount of good would arise out of such genial association.

Hundreds and thousands of pounds might, as your correspondent observes, be saved by an intercourse of the managers of a district who would be most willing to communicate many of their experiences which they have no object in keeping to themselves.

That your correspondent may judge of the quality of our papers, I send you three in which he may probably feel interested, the first being the results of working the Weldon process at one of the largest manufactories on the Tyne; the second is on the manufacture of oil of vitriol and soda-ash by a thoroughly practical manager; and the third is an account of the construction of a chemical works erected in Ireland by the author of the paper, accompanied by a complete set of plans and sections, which have been photographed and distributed to the members.

Now, Sir, I contend that if societies like these were formed in various manufacturing districts, we could easily form an Association of Manufacturing Chemists, holding an annual gathering as "Frank" proposes.

I don't see why a commencement should not be made this autumn.

If any of your correspondents feel sufficient interest in the matter, I shall be happy to give them any further information about the above-named society, and I am sure the chemists of Newcastle will be most happy to greet their professional brethren here, if they will make this town the scene of the first meeting of the Association.—I am, &c.,

WILLIAM CROWDER,
Hon. Secretary Tyne Social Chemical Society,
Manager of Langdale's Chemical Manure Co. (Limited), Newcastle-on-Tyne.

P.S.—As to the use of Coffey's still in the manufacture of ammonia, if your correspondent refers to vol. i., pages 180 and 181 of Muspratt's "Chemistry," he will find that it is an expired patent by Newton (1841), and there are some particulars which may prove useful to him.

ANALYSES OF MANURE.

To the Editor of the Chemical News.

SIR,—Annexed is copy of analysis, made by a public analyst, of a sample of dissolved bones taken from the stock of a well-known manufacturer. The sample is said to contain *nitrogen* equal to 3·57 of ammonia. No mention is made of the addition of ammoniacal salts. It appears to me that there is here an exceptionally high amount of ammonia for so-called "dissolved bones," especially as I understand there is no such thing as pure dissolved bone manure. If manufacturers do not dissolve some mineral phosphates along with the bones, they must use a large quantity of some article to dry them up after dissolving. But assuming that in this case the bones (pure) contained 4 per cent of ammonia, and that nothing was added except acid, either before or after dissolving, is it possible that the manure should contain 3·57 per cent of ammonia? If it cannot in the circumstances stated, then it is certain it cannot after the indispensable "dry" has been added.

Will any of your numerous readers be good enough to give an opinion on this point in an early issue.—I am, &c.,

MANURE.

June 14, 1872.

Copy of Analysis.

	Per cent.
Moisture	11·73
*Organic matter	24·57
†Biphosphate of lime	10·64
Insoluble phosphate	21·72
Hydrated sulphate of lime	26·14
Alkaline salt	4·00
Sand	1·20
	100·00

* Yielding nitrogen equal to ammonia, 3·57.
† Equal to bone asphalte made soluble, 16·86.

DENDRITIC SPOTS ON PAPER.

To the Editor of the Chemical News.

SIR,—Since I was unavoidably absent from the meeting of the Chemical Society held on Thursday, June 6, perhaps I may here be permitted to reply to Dr. Müller's remark upon my note on "Dendritic Spots on Paper," in which paper I show that the majority of such spots have an inorganic and not a vegetable origin, as was formerly supposed, and that they arise from small metallic particles present in, or adherent to, the surface of the paper.

Dr. Müller commented on the paper, and said "he had long ago observed these dendritic marks and knew them to be caused by portions of the bronze detached from the paper-making machinery." (*Vide* CHEMICAL NEWS, June 14, 1872).

Now, in 1869, when proceeding with the investigation of these spots, I wrote to Messrs. De la Rue and Co., asking them to kindly supply me with a quantity of paper containing such markings, of which I enclosed specimens, mentioning, I believe, in my letter the purpose for which I required it, and stating that I had found copper present in these dendritic spots, but had not at that time ascertained its state of combination, and therefore wished for a supply of material to enable me to do so.

In reply, I received a very courteous note from Dr. Müller, as follows:—

"110, Bunhill Row, E.C.,
July 5, 1869.

"Sir,—Your letter, dated 24th June, is to hand this morning. With regard to the spots you refer to, I would mention that this defect occurs sometimes with the paper, and it appears to me to be caused by being kept in a damp place, which condition favours the peculiar *fungoid growth* to which I ascribe these marks. I have none of this kind of paper at present at my disposal, but search is being made for it at my order, and should it be successful I shall be happy to forward you some for your investigation.—I am, Sir, your obedient servant,

"HUGO MULLER."

Hence it is evident that at that date Dr. Müller regarded the spots as vegetable growths, and has since modified his views in accordance with the communication which I made to him.

The dendritic markings mentioned by Messrs. Friswell and Spiller as occurring on prepared albumenised paper must have been noticed by everyone who has anything to do with such prepared paper; but then these markings bear no very near relation to the ordinary dendritic spots found on paper, for the former consist of metallic silver reduced by particles of some metal, such as iron, copper, &c., and the silver has crystallised out in an arborescent form, while the latter consist mainly of copper in combination with sulphur.—I am, &c.,

ARCHIBALD LIVERSIDGE.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Annalen der Chemie und Pharmacie, No. 8, 1872.

This number contains the following original papers and memoirs:—

Hexyl-alcohol Obtained from Heracleum Oil, and on the Capronic Acid Prepared from it.—A. Franchimont and Th. Zincke.—After first briefly referring to Dr. Wohler's researches on this

subject, the authors state that they received about 200 grms. of the essential oil of an heracleum species (probably the *Heracleum giganteum*) grown in the Zoological Gardens in London, the oil being distilled there from the fruit of the plant alluded to. It appears that this oil consists of acetic acid octyl ether and butyric acid-hexyl ether, two isomeric ethers which can be separated from each other by fractional distillation. This memoir also treats on—Hexyl-alcohol, $C_6H_{14}O$, a colourless liquid insoluble in water, exhibiting a strongly aromatic odour, boiling at 156·6°; sp. gr.,0·819; on being oxidised this alcohol yields a fatty acid of the formula $C_6H_{12}O_2$. Hexyl-iodide, $C_6H_{12}I$, a liquid insoluble in water, boiling at 179·5° at 752·46 m.m. barom.; sp. gr. 1·4115. Hexyl-acetate, $C_6H_{13}O.C_2H_3O$. Hexyl-caproate, $C_6H_{13}O.C_6H_{11}O$. Capronic acid, $C_6H_{12}O_2$, an oily fluid, remaining liquid even at −6°, boiling at 205°. Capronic acid ethyl-ether, $C_2H_5O.C_6H_{11}O$, a pleasant smelling fluid: sp. gr. 0·876 at 17·5c, boiling at from 164·5° to 165·9°. Capronate of baryta—

$$Ba(C_6H_{11}O_2)_2+H_2O.$$

A large portion of this lengthy essay is devoted to the discussion of the question of the relation existing between the hexyl alcohol alluded to, its derivatives, and other bodies of similar composition.

Gallic Acid and Gallic Acid Ether.—H. Schiff.—The author refers to his former researches on this subject, and also to the researches of others, more particularly to those of Nachbaur, who stated that by treating gallic acid with chloracetyl there should be formed tetracetyl-gallic acid. According to the author this is not correct; on repeating the experiment the author obtained a body which, on being analysed, led to the formula—

$$C_6H_2\begin{cases}CO.OH\\O.C_2H_3O\\O.C_2H_3O\\O.C_2H_3O\end{cases}$$

that is to say triacetyl-gallic acid; with chlorbenzoyl (which corrodes glass rapidly) gallic acid yields tribenzoyl-gallic acid, a resin-like material, which becomes soft at 85°; formula:—

$$C_6H_2\begin{cases}CO.OH\\(O.C_7H_5O)_3\end{cases}$$

Gallic acid ether; the formula of the lead salt of this body is—

$$\left.\begin{matrix}C_7H_2(C_2H_5)O_5\\C_7H_2(C_2H_5)O_5\end{matrix}\right\}Pb_3''$$

Anhydrides of Salicylic Acid.—H. Schiff.—Notwithstanding the intrinsic value of this memoir, its contents, elucidated by a series of very lengthy and complex formulæ, are not suited for abstraction.

Action of Phosphorus Oxychloride upon some Acids.—H. Schiff.—It appears that when the oxychloride alluded to acts upon acids, most of these, including even concentrated sulphuric acid, are decomposed, while metaphosphoric acid is formed; when the oxychloride is made to act upon phenolsulpho acid the result is the formation of anhydride of two molecules of the sulpho acid—

$$2C_6H_6SO_4-H_2O=C_{12}H_{10}S_2O_7.$$

New Nitro Acid.—H. A. Kullhem.—The author gives a detailed account of the mode of preparation of dinitro-heptyl acid, the result of the very prolonged action of boiling nitric acid upon camphor. The acid alluded to, $C_6H_{10}(NO_2)2O_2$, is a solid body, slightly soluble in water, crystalline, readily soluble in alcohol and ether; volatile at 100°, fusible at 215°, but with decomposition. The salts of this acid detonate when heated to 150°; most of the salts are crystalline bodies.

Researches on the Inorganic Constituents of Blood.—A. Jarisch.—The first instalment of an exhaustive monograph on this subject. This portion, elucidated by a large number of tabulated formulæ exhibiting results of experiments, treats on the blood of dogs. The temperature of the body of the dogs seemed to show that they were in a healthy condition.

Analysis of the Meteoric Iron of Ovifak in Greenland.—Dr. F. Wohler.—This is an exhaustive essay on the best and most expeditious methods of analysis of these minerals. The composition of the meteoric iron of Ovifak is percentically quoted as—Iron, 80·64; nickel, 1·19; cobalt, 0·47; phosphorus, 0·15; sulphur, 2·82; carbon, 3·69; oxygen, 11·09; total, 100·05.

Notice on Tyrosin.—L. Barth.—This brief paper contains some observations on the researches on tyrosin made by Beilstein, Kuhlberg, Glaser, Piria, and others. The author thinks that the synthetical composition of tyrosin has not yet been accomplished.

Bulletin de la Societe Chimique de Paris, No. 8, April 15, 1872.

The only original paper contained in this number treats on the—

Action of Iodide of Lead upon some Metallic Acetates.—D. Tommasi.—According to the reactions which take place between these two bodies, the acetates can be divided into three groups, viz.:—Such as combine with plumbic iodide (only acetate of potassa belongs to this group); acetates which, while reacting upon plumbic iodide, give rise to phenomena of double decomposition (diacetate of copper and acetate of mercury); acetates which act upon iodic plumbic simply as solvents (for instance, acetates of soda, ammonia, iron, &c.). The formula of the combination of plumbic iodide and acetate of potassa, also termed plumbic iodacetate-aceto-potassic, is—

$$\left[\left(\begin{matrix}(C_2H_3O)_2\\Pb''\end{matrix}\right\}O_2\right),I_2Pb'',\begin{matrix}C_2H_3O\\K\end{matrix}\Big\}O\Big]3\left(\begin{matrix}H\\H\\H\end{matrix}\Big\}O\right)^*$$

or—

$$\left[2\left(Pb''\left\{\begin{matrix}[O(C_2H_3O)]'\\I\end{matrix}\right)\begin{matrix}C_2H_3O\\K\end{matrix}\Big\}O\right]3\left(\begin{matrix}H\\H\\H\end{matrix}\Big\}O\right)$$

* O=16; C=12; Pb=207.

This memoir abounds with formulæ, while it also contains an account of the mode of preparation of the various salts and bodies described. Acetate of soda appears to be an excellent solvent for plumbic iodide.

Le Moniteur Scientifique Quesneville, No. 366, June, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

New View and Practical Observations on Typhus, Yellow Fever, Intermittent Marsh Fevers, and Peruvian Scorbut (Verrue Péruvienne).—Dr. M. C. Tasset.—A valuable contribution to the science of medicine, more especially in relation to the climate of Peru.

Crystallised Aconitine.—M. Duquesnel.—This essay relates to the history of the discovery of aconitine, and to the researches made on *Aconitum napellus*, by Steinacher (1808), Brandes (1819), Hesse (1833), von Planta Reichenau, Hottot, Grove, and others (the last-named author appears to have been the first to obtain crystallised aconitine). A lengthy account is given of the mode of preparing this substance, the formula of which is $C_{34}H_{40}NO_2$. From 0° to 100°, either in the presence or absence of water, heat has no action upon crystallised aconitine; it is almost insoluble in cold and boiling-water, and is partly decomposed and partly volatilised at 130°. It is soluble in alcohol, ether, benzine, and especially in chloroform; insoluble in glycerine, and light, as well as heavy, petroleum oils. Solutions of aconitine exhibit a feeble alkaline reaction to test-paper, while the alkaloid forms, with acids, salts which readily crystallise. Phosphoric acid, tannin, iodide of potassium, and the double iodide of potassium and mercury are the most sensitive chemical reagents for this alkaloid, the detection of which, according to the author, has to be aided by physiological experiments. A large part of this paper is devoted to the pharmaceutical preparations of aconite and aconitine.

On Fermentations: Examination of the Latest Discussions on this Subject as treated by Drs. J. von Liebig, Pasteur, and Fremy.—Dr. C. Blondeau.—Notwithstanding the intrinsic merits of this very exhaustive and lengthy memoir, its contents are not suited for abstraction. Incidentally, the author observes that Becher (1670) has been the first to observe some kind of analogy to exist between combustion and fermentation.

Note on the Analysis of Soaps.—F. Jean.—Reserved for full translation.

Les Mondes, June 27, 1872.

This number contains no original matter relating to chemistry, but we call attention to the following paper:—

Labours of the Italian Spectroscopistic Society.—M. Tarry.—A condensed account of the observations made at the astronomical observatories of Italy in relation to the sun.

Revue Universelle des Mines, de la Métallurgie, des Travaux Publics, des Sciences et des Arts Appliquées à l'Industrie, Nos. 1 and 2 (double number), 1872.

In addition to several important original papers bearing upon engineering, mechanical, and metallurgical subjects, this number contains the following original paper relating to chemistry:—

Water of Hatray, near Spa, Belgium.—T. Kupfferschlaeger.—The author states that, in a rather secluded locality opposite to the village of Sart, there constantly issues from the rocks an abundant quantity of water, which forms a rivulet at the base of the rocks and flows along the embankment of the railway, finally entering a large watercourse. It appears that this water, which hardly tinges blue litmus-paper red, is not rendered turbid by ferrocyanide of potassium, carbonate of ammonia, salts of baryta, or oxalate of ammonia; it contains only 0·05 grm. of solid matter to the litre, and is therefore well suited for domestic and industrial purposes. At present this water is turned to no use at all, while (especially for paper-making and other industrial applications) it is of great value, being far purer than most natural waters, excepting some met with in Sweden, Spain, and Switzerland.

La Revue Scientifique de la France et de l'Etranger, June 29, 1872.

This number contains no original papers relating to chemistry, but there is the concluding lecture on—

Animal Heat and the Influence of the Sympathetic Nervous System upon the Circulation of the Blood.—Dr. C. Bernard.

NOTICE TO AMERICAN SUBSCRIBERS.

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THE CHEMICAL NEWS.

Vol. XXV. No. 659.

ON FERRO-TUNGSTINE,* A NEW AND INTERESTING MINERAL.

By HUGO TAMM.

Some years since, a sample of a very remarkable mineral came to my hands. I was then unable to find out the place where it was originally discovered; and as I have not been any more successful since in my attempts to trace it to its source, I publish the result of an incomplete investigation of this substance, in order to call attention to it and rescue this really interesting mineral from oblivion.

The sample I had in my possession was so very small that this must be my excuse for not giving a fuller account of its composition and properties; but, with the description which I am going to give of it, it will be very easy to pick it out wherever it exists, whether along with other minerals, in mines, or among unexamined specimens in museums.

Ferro-tungstine is a dark steel-coloured, heavy, crystalline powder, formed of separate and distinct crystals, presenting exactly the appearance of crystallised silicium. Its specific gravity, which is considerable, is 12·5. It is a very hard substance, which can only be porphyrised with extreme difficulty, and it is almost impossible to reduce it to an amorphous powder; the powder obtained after a prolonged porphyrisation remaining still bright, like the powder of a crystalline metal or alloy, and crystalline.

Heated in the air at a low red heat, ferro-tungstine slowly oxidises, and is converted into a yellow powder of tungstic acid; and when it is thrown in fused nitre, it burns with brilliancy and is thoroughly attacked.

Ferro-tungstine is composed of—

Metallic tungsten	88·05
Metallic iron	5·60
Metallic manganese	0·15
Undetermined substance	6·20
	100·00

I have no reason whatever to doubt the accuracy of the estimations of tungsten, iron, and manganese, which were repeated twice over with identical results, and I am quite at a loss to imagine what the undetermined substance may be; but this of course will easily be ascertained as soon as larger samples of the mineral are found.

It is not oxygen, for ferro-tungstine heated in a current of hydrogen does not lose any portion of its weight; nor does it when heated at a very high temperature in a carbon crucible. And yet the hypothesis of oxygen was very tempting, when we consider that, had the undetermined substance been oxygen, tungsten would have existed in the state of a new oxide—a suboxide.

The hypothesis of sulphur was equally fascinating, for in that case tungsten would exist as a new sulphuret—a subsulphuret; but ferro-tungstine does not contain a trace of sulphur.

It may be phosphorus, but it is not arsenic, and I do not believe that it is a metallic substance. What is it then?

If I had been absolutely certain of the specific gravity of ferro-tungstine to the third decimal, I might easily have calculated the specific gravity of the undetermined substance, and I might easily afterwards have verified the indications given by specific gravity; but, although the specific gravity, 12·5, which I give is sufficiently correct for any practical purpose, I do not feel justified in forming any conclusions based upon it.

It is possible that the undetermined substance is hydrogen, or rather hydrogenium; in which case ferro-tungstine would really be a most remarkable mineral, being the first example of a native alloy of hydrogenium; but I had exhausted the small sample on which I operated when the thought struck me that it might be so.

It is possible, also, that nitrogen is the substance in question, or that it is a new element.

Lastly, it may be after all an analytical error, and there may be 6·2 per cent more tungsten than shown by the analysis, but I have strong doubts on that point.

But, as soon as ferro-tungstine is found anywhere, any obscure point of its history will soon be cleared by myself or by others.

* Mr. Tamm has done me the honour to propose that this mineral shall be called either "Crookesite" or "ferro-tungstine," and has left the decision to me. The name Crookesite having already been used by Nordenskjold to designate a mineral containing a large quantity of thallium, I am unable to accept the honour proposed by Mr. Tamm, and have accordingly adopted the second name. At the same time, I would propose that the more appropriate name "Tammite" should be employed for this curious mineral as soon as the missing constituent is identified.—W. Crookes.

CUTANEOUS ABSORPTION.

In a recent note to the Paris Academy, M. Bernard writes as follows:—

I desire to submit to the Academy an account of experiments made in the Vincennes Asylum as to cutaneous absorption in baths of medicamental vapour. In such an institution, among patients with various chronic affections, I am favourably situated for experimenting on this question on a large scale.

Reveil's memoir on the subject gives the facts which are known up to the present. "Absorption in the bath," he says, "only takes place in rare and exceptional circumstances; it is facilitated by washing the skin, continued rubbing, and by certain irritant and solvent substances."

The bath apparatus consisted of a furnace, a boiler, a chamber in which the steam coming from the boiler was charged with the substance to be applied, and a wooden cage, in which the patient was seated while enveloped in the vapour.

I used iodide of potassium in my experiments—(1) because it is not volatile; (2) because its presence in urine is easily determined by nitric acid and chloroform; (3) because, in seizing the iodine set at liberty by the nitric acid, the chloroform takes a rose colour varying in a marked way with quantity, and thus, by comparing with a graduated scale, one may determine pretty accurately, and without quantitative analysis, the quantity of iodide of potassium in the urine.

The skin of the subjects experimented on was intact, without wound or scratch. The urine was examined before the bath was taken, and the absence of iodine ascertained. By a respiratory tube, the patient breathed the external air through his mouth, the nostrils being pinched. A thick sheet of caoutchouc was bound by a T-bandage over the anus; the penis was sheathed in the same material; while the hands and feet were wrapped in cotton and gummed taffeta.

The subject was then placed in the cage, and subjected for thirty minutes to vapour from the mixing chamber, into which there had been put 20 grms. of iodide of potassium. The temperature in the cage was gradually raised to 45°; the skin of the subject became wet. He was then wrapped in a woollen covering and put in bed, when profuse perspiration took place. The urine analysed two hours after the bath gave a rose colour: some taken three hours after gave a much more lively colour; thus affording clear proof of the absorption of iodide of potassium through the skin, the only way it could have entered the system. Besides, if it had entered by pulmonary passages it would have been eliminated immediately after the bath.

These first experiments, then, prove the fact of cutaneous absorption.

In a second series I sought to determine to what temperature the air, mixed with medicamental vapour, must be raised, in order to the absorption taking place.

A very sensitive thermometer was applied to the breast of the subject, and the temperature of the bath varied in the series of experiments from 30° to 38°, the time being, as before, thirty minutes. I only found the absorption take place when the temperature was 38° (or one degree above the temperature of the body). Indeed, the sebaceous matter in the cells of the epidermis only commences to dissolve at 38° when the skin is really wet; it is then that imbibition takes place, and consequently absorption. The iodide of potassium, conveyed mechanically by the vapour, penetrates the epidermis, whence it passes into the capillary blood system and the other organs.

Thus we understand how absorption does not generally take place in a water-bath. Owing to the density of the water, and its great specific heat, the temperature of such baths is usually not raised beyond 30° to 33°. Dr. Homolle remained in a bath at 34° or 35°; would he have been able to bear 38° or 39°? Besides, the liquid layer touching the skin is not constantly renewed, as in the vapour-bath.

I succeeded, however, in obtaining the cutaneous absorption at a temperature under that of the body, in the following way:—

The subject had first a simple vapour-bath, to destroy the sebaceous matter; his skin was washed and carefully dried, and he was replaced immediately in the cage, where he was exposed to the vapour of iodide of potassium for thirty minutes, the temperature of the bath varying, in several experiments of this kind, from 34° to 36°. Two hours after a bath at 34° the colouration of the urine was slightly rose; after a bath at 36° it was much more distinct.

M. Colin has described an experiment in which he allowed water charged with cyanide of potassium to fall for five hours' time on a horse's back. This caused the death of the animal; the sebaceous matter having been destroyed through percussion, and cutaneous absorption taking place.

In the sand-baths at Cette and Arcachon, which are found so efficacious for scrofulous affections, tumours, &c., what takes place? The temperature being considerably above that of the body (over 40°), the skin is wet, the sebaceous matter dissolves in the perspiration, and there follows absorption of the salts contained in the sand.

I have not been able to find free iodine in the urine; the use of nitric acid has always been necessary. Besides. iodine once introduced into the system soon forms various compounds.

In summing up his results, M. Bernard further mentions that the elimination of the salt, commencing two hours after the bath, increases in quantity till a meal is taken, after which it diminishes (probably because of the water received into the system), and then again increases. It ceases completely twenty-four hours after the bath, whatever the amount of the salt, the temperature, or the duration of the bath.

A. B. M.

ON THE CONSTITUTION OF MILK AND BLOOD.

By M. DUMAS.

During the most troubled years of the first French revolution, the old Academy of Sciences of Paris having been suppressed, its members none the less continued their patriotic co-operation in the labours required by the new necessities of the country. History has given them credit for this. It associates the names of the principal of them with those of the illustrious administrators and generals, who then caused the integrity of the French soil to be respected.

The editors of the *Annales de Chimie*, who had been compelled to suspend their publication under the reign of Terror, on resuming it had the happy thought of collecting, in two volumes, all the memoirs or reports with which the Academicians had been charged. In running through these we appreciate at a glance the importance of the questions which were addressed to them, the insufficiency of the means at their command during those troublous times, and the merits of the practical solutions which they presented to the country, as the fruit of their previous studies, or of their improvised experiments.

Saltpetre, gunpowder, steel, weapons, gun-metal, potash, soda, soaps, paper, assignats, and many other objects implicated in the defence of the country, the working of its manufactures and the necessaries of life, gave occasion to investigations and discoveries of which the factories have not yet forgotten the tradition.

The siege of Paris by the Prussian army could not, it was said, be sufficiently prolonged to raise any questions of the same kind; but nevertheless it has been necessary, as in the time of our fathers, to seek for nitrated earths, to produce gunpowder, to manufacture and work up steel, to obtain bronze and cast cannon; we have also been in want of paper, and of a great number of useful objects.

Considerable, although rapid, investigations have been accomplished; and it will be useful as well as just not to allow their memory to be lost. I have busied myself in collecting the materials for this publication, which I shall carry out as soon as circumtances will permit.

Among the privations which our forefathers did not know in their most cruel intensity, those which caused the most decided sufferings to the existing population, relate to the want of combustibles, which was rendered intolerable and most destructive by an exceptionally rigorous winter—to the scarcity of milk and eggs, the certain cause of the premature decease of a great number of young children—and, finally, to the exhaustion of the supplies of corn, flour, and meat, which, rendering the capitulation of Paris inevitable, marked the precise day for it.

Three questions, which have occupied the mind of every man curious to foresee the future of science, were thus incessantly presented to the meditation of the scientific men shut up in Paris, not as far-away dreams in which the imagination delights and disports itself, but as the despairing prayers of a people in utter extremity:—

1. To obtain available heat, without combustibles;
2. To re-construct food with mineral materials, without the co-operation of life;
3. To reproduce, at least, the essential food of man with non-alimentary organic materials.

Man, in warming himself by means of combustibles furnished either by the existing vegetation, or by the remains of the ancient vegetation of the globe, and in nourishing himself by means of products obtained from plants and animals, demands everything from life; but could he dispense with life in obtaining his combustible and his nutriment? Would the forces of science alone suffice to assure to him, in this urgent need, those satisfactions which he could no longer demand from the forces of living nature?

This was the question. If put in a time of peace and in the midst of abundance, it would probably have received more than one response in the affirmative. The progress of the physical sciences has been so brilliant! One is so much disposed to exaggerate their power! Electricity opens up such seductive perspectives! Synthesis has produced so many marvels in the hands of chemists!

If the necessity had not been so pressing, so that the question might have been raised as a philosophical thesis, and we could have said to the physicists and chemists, could you not, if it were necessary, furnish man with heat and food without having recourse to plants and animals? how many, without saying *yes*, would at least have answered with one of those smiles which do not say *no*.

But in a crisis where it was necessary to realise immediately what would have been left to hope, people showed reserve; radical solutions were adjourned, and there was no question either of heating Paris without combustibles, or of feeding it without organic aliments.

But could organic materials usually disdained be converted into aliments, so as to replace, by means of clever combinations, those natural products which could no longer be procured?

It is not my design to notice what viands were served at table, or what resources we were led to seek in the blood and offal of the slaughter-houses which are usually thrown away, the bones, feet, and even the skins of the cattle slaughtered. Nor will I examine how the butter and lard, which were speedily exhausted, were replaced. Of these improvised arts some have disappeared with the circumstances which gave them birth, whilst others have left some useful teachings.

I shall treat only of a special question, the solution of which involved certain principles which it seems to me to be important to guard. Was it not possible to come to the assistance of new-born children by replacing the milk, which could no longer be got, by some saccharine emulsion? In this case there was no question of creative chemistry, but only of culinary chemistry. Recipes were not wanting, all reproducing an albuminous liquid, sugar, and an emulsion of a fatty body.

As a provisional succedaneum this artificial milk deserved to be welcomed. But sometimes there was such a conviction in the authors of these propositions, that one was forced to dread for the future the effects of their faith. This was of a nature to make too many proselytes, to the great injury of the children at nurse, and the great profit of the dealers in milk. How could the latter have the least scruple when they were taught to manufacture an emulsion which they saw recommended to the consumers, and even to mothers, as the real equivalent of milk?

The services rendered by concentrated milk during the siege were too important to render any excuse necessary in the country which produces it, when we insist upon the preference always due to natural milk, as also upon the characters which at present do not permit us to confound any artificial milky liquid whatever with the truly secreted product.

Natural milk forms a liquid containing salts, sugar, casein in solution, and fatty globules in suspension. Let us first see whether we can imitate these fatty globules by dividing or making an emulsion of an oily or fatty matter in a viscous liquid.

I believe that I experimentally demonstrated the contrary some years ago, by showing that the globules of fatty matter of milk are protected from certain physical or chemical reactions by a true membranous envelope. Admitted by some, and disputed by others, the existence of this membrane seeming to me to be real and proven, there could be no question, in my opinion, about confounding an artificial emulsion with naked fatty globules with milk from the mammæ, presenting fatty globules enveloped by a membrane, true free cells, filled with butter, analogous to the agglutinated cells of adipose tissues.

The existence of this membrane may be proved by two chemical experiments.

The first depends upon the property possessed by sulphuric ether of dissolving fatty matters and collecting together those which are suspended in liquids, provided that they are free. Now if, after shaking together in a tube fresh milk and ether, they are left to rest, the ether floats on the surface without having dissolved anything, and the milk resumes its place below the ether without having lost anything of its appearance, or yielded any of its buttery matter.

But when subjected beforehand to the action of acetic acid, which is able to dissolve the envelopes of its fatty globules, milk, when shaken up with ether, loses its opacity, and yields its butter to that liquid, in which it may be found.

An inverse test leads to the same conclusions. A neutral salt, such as sulphate of soda, added to milk, enables us to filter it, and to retain upon the filter the globules of butter, whilst the serosity flows off perfectly limpid and clear. If the washings with saline water be continued, these globules may be freed from all the soluble products of the serum. Now if the butter consisted of simple fatty globules, there would then remain with them no trace of albuminous or caseous matter. But whatever care may be taken to prolong the washings, we always find with the fatty matter such a proportion of albumenised substance that there can be no doubt that it has remained there in the form of those envelopes or cells which constitute the globules of butter.

The microscope, moreover, shows plainly the constitution of the globules of butter, and reveals the constant presence of the envelopes. It is sufficient to crush the globules of milk by means of the compressor, to obtain a conviction that, after the spreading of the fatty matter, the butter-cell still retains its form and outline, thus showing that the contents and the container have each their distinct existence.

For these reasons, and for many others (for no conscientious chemist can assert that the analysis of milk has made known all the products necessary to life which that aliment contains), we must renounce, for the present, the pretension to make milk, and especially abstain from assimilating any emulsions to this product.

Besides we cannot have too much reserve where we have to pronounce upon the identity of two products, one natural, the other artificial, if they are not crystallisable or volatile—that is to say, definite. We can never affirm that we have reproduced a mineral water, or sea-water for example. When manure for plants, or aliments for man and animals are in question, is not the same reserve still more imperative?

These indefinite natural mixtures contain substances which the coarsest analysis discovers, with others less strongly characterised or less abundant, which are only revealed by delicate chemistry, and others again, and perhaps the most essential, which still escape us, either because they exist in infinitesimal proportions, or because they belong to the category of bodies which have not hitherto been distinguished from other chemical species.

It is therefore always prudent to abstain from pronouncing upon the identity of these indefinite mixtures employed in the sustenance of life, in which the smallest and most insignificant traces of matters may prove to be not only efficacious, but even indispensable. In proportion as science extends her domain, we are sure to see the demonstrations of the appropriateness of this reserve multiplied.

Among the fine investigations executed in France by those who have continued the labours which occupied the life of the illustrious Théodore de Saussure, the important thesis of M. Raulin upon the vegetation of *Aspergillus niger* will always be placed in the foremost rank. All the conditions of the life of this Mucedinean have been so well determined by that author that it may be cultivated with precision in a soil formed of definite chemical species, as if we had to do with the formation of a compound; and the soil once sown, we may follow the transformation or the employment of each of the elements necessary to its life, just as if we had to do with the development of an ordinary chemical equation.

Now, who could have foreseen that the *Aspergillus niger*, which has just made its appearance, for example, upon a slice of lemon, exposed to the air, required for the fulness of its existence traces of *oxide of zinc*? How, after this, can we doubt, in the case of plants of a higher order and especially of animals, that, besides their coarsely appreciable aliments, they require also traces of many other aliments, more delicately used but not less necessary?

Milk has often been compared to eggs, both from a chemical and a physiological point of view. Their mission is equally to furnish the young animal with the

nourishment of its earliest age; and they have as a common character that they present in union a fatty matter, an albumenoid substance, a saccharine or amylaceous matter, and salts.

But the egg possesses a vitality, an organisation, of which chemistry furnishes no evidence, and which the most minute anatomy would be powerless to reveal. If fecundation had not rendered manifest, by the rapid phenomena of segmentation which take place in it, that the mass of the yolk of an egg is endowed with life, and that it obeys the impulsion of the living germ which takes possession of it, we should still be ignorant that the yolk of the egg is not a mere emulsion of inert fatty matter.

Is not milk in the same case? One is led to think so when we see that the yolk of the egg and milk have the same destination and the same configuration, and that, if the yolk obeys the action of the germ which is nourished by it, milk, for its part, proves to be singularly ready to receive and nourish germs of more than one kind, which, on reaching it, become developed and live at its expense.

The power of synthesis of organic chemistry in particular, and that of chemistry in general, have therefore their limits. The siege of Paris will have proved that we have no pretension to make bread or meat from their elements, and that we must still leave to nature the mission of producing milk. If some illusions upon this point have found their way into the minds of persons ill-informed as to the true state of science, they are due to the dangerous play of words to which the expressions *organic chemistry* and *organic substances* lend themselves, when applied, as these are, indifferently, to definite compounds, such as alcohol or citric acid, which are unfitted for life, and to indefinite tissues, the seat of life.

The former (foreign to life, and true chemical species) are the only ones that synthesis has reproduced. The latter, which can be formed only under the impulse of a living germ, and which receive, preserve, and transfer the forces of life, are not definite species; the synthesis of the laboratories does not reach them. The only synthesis which has hitherto been observed in the case of the chemical materials which constitute living tissues, is that determined in brute matter by the presence and impulse of the living germ itself.

All those chemical syntheses, otherwise so worthy of interest, which have been indicated as reproducing organic matters, have therefore in reality reproduced only matters, unfitted for life—that is to say, mineral matters. Thus of every living matter or matter that has lived, we must still, whether we speak as chemists or physiologists, say what was said of it formerly: *omne vivum ex ovo*—that which is not life has brought nothing to life.

With regard to the constitution of milk, the phenomena presented by the clarifying of butter have been sometimes employed either to demonstrate or to dispute the existence of the membranes which envelope the butyrous globules; I cannot at present regard these phenomena as having any value in this respect.

It has been said, for example, that the separation of butter was the result of the formation of lactic acid arising from the action of the air, favoured by churning. Numerous experiments effected in my laboratory upon a practical scale have shown that butter separates equally promptly, and at least equally abundantly, from a milk to which a large amount of bicarbonate of soda has been added, as from natural milk. The alkaline reaction of the former, which is maintained during the operation and after its completion, has no influence either upon its duration or its result. The proportion of butter, far from being diminished, seems even to have been increased by it.

The formation of lactic acid is therefore not necessary for the separation of butter, which appears to me to be due to purely mechanical causes. Such, at least, is the feeling that one experiences on examining by the microscope milk submitted to churning whilst the operation is going on. The first test-drops present nothing peculiar; the globules of butter retain their form, dimensions, and aspect. Soon we see appear irregular butyrous islands in the midst of globules remaining unaltered. These islands of butter increase in number and extent in proportion as the operation proceeds. They form a snowball, uniting witheach other and becoming agglomerated, so as to constitute at last the mass of butter which is the object of the operation.

The agglomeration of the butyrous globules into a block of butter would be a true regelation if there were no membrane surrounding them. The existence of this compels us to admit that it must be broken, and that this is the object of the repeated shocks which we make the liquid undergo, in order that the diffused butter may unite with the fatty parcels and agglomerations which it meets with on its road.

If it is true that the separation of butter is a purely mechanical phenomenon, it is not the less so, as I shall hereafter show, because chemistry can give rules to render this operation more rapid and more efficacious, and to produce from it a better clarified and less alterable butter.

I conclude this communication with some details upon phenomena of another nature, towards which the hygienic situation of the inhabitants of besieged Paris turned one's thoughts only too naturally. What took place in the tissues of this population deprived of fresh vegetables, fruits, milk, fish, and fresh meat? What changes did the blood undergo under the influence of this diet? and how must they manifest themselves?

Some years ago I had prepared some experiments, the object of which was to ascertain whether exchanges by exosmose and endosmose take place between the internal liquids contained in the globules of the blood and the liquids of the serum. If these exchanges were easy and rapid, their existence might be ascertained. To demonstrate them would be to ascertain by what means the constitution of the globules of the blood may be altered and vitiated, re-established, or regenerated.

I never completed these experiments; but I have often depended upon the views which guided me, in order to make the auditors in my courses at the Faculty of Medicine understand how certain alterations of the blood might be interpreted.

It is necessary, perhaps, to explain what stopped me.

Nothing is easier than to compare the serum and globules of a normal blood with the serum and globules of the same blood, modified by the intervention of a substance capable of changing the direction or the intensity of the powers of endosmose between the globules and the serum.

In the blood of a living animal the globules suspended in the liquid may absorb or lose some of their elements, if we succeed in changing the constitution of the serum; but how long will the phenomenon last? If the substance added be mischievous it will be eliminated; the veins on their part will absorb liquids destined to re-establish the equilibrium, and the experiment will soon be so altered that the little differences that we have to measure will disappear, vanishing before great complications.

On the contrary, if we withdraw the blood from the body of the animal and divide it into two parts of equal weight, one destined to furnish the term of comparison, and the other to receive the substances modificative of the power of endosmose, coagulation and what I have called the asphyxia and death of the globules will soon do away with any hope of arriving at certain results.

It was therefore necessary to receive the blood into a vessel, to oppose its coagulation, and to replace towards it the action both of the heart and lungs—that is to say, to keep the blood in movement and to present it in a very divided state to the action of oxygen or of the air. I arranged an apparatus which fulfilled these conditions, and allowed one to ascertain how alcohol, neutral salts of soda or potash, sugar &c., act when added to the serum, and how the interior liquids contained in the globules may become modified under their influence either in quantity or in nature.

While I followed out these views, preoccupied by the

evident invasion of scurvy in the general state of health of the inhabitants of Paris towards the close of the siege, and whilst I sought to make up by applicable means for the absence of all fresh vegetables and of all fruit in their habitual diet, a foreign doctor, Dr. J. Sinclair, by following out the ideas which he had heard me teach upon this subject, was led to seek in them the explanation of the first symptons of alcoholisms, a state which he designates by the name of dypsomania.

Just as scurvy would have as its primary cause an impoverishment of the serum in potash-salts and a surcharge of salts of soda (which favours the exosmose of the potash of the globules and consequently their destruction), so alcoholism would have as its starting-point the presence of alcohol in the serum of the blood and its effects on the globules.

Alcohol added to the serum causes a movement of exosmose from the interior of the globules to the serum. The globules lose a part of their constituent liquids; and this alteration, which brings on others, is no doubt reproduced in the cells of the various tissues which are bathed by alcoholised liquids.

What it is now my intention to prove is, that in the blood in particular, and in every living organism of analogous constitution (that is to say, formed by cells or utricles filled with a liquid and floating in or bathed by a liquid), it is sufficient to alter, even slightly, the chemical composition of the exterior liquid to cause that of the interior liquid to become modified by endosmose or exosmose.

I propose to follow out the development and application of this principle, either to demonstrate the effects produced by the action of common salt, alcohol, &c., upon the blood, or to show how rapid is that of some agents, of which I have already examined the action, upon the constitution of the globules.

STEAM-BOILER WATERS AND INCRUSTATIONS.*

By Dr. JOSEPH G. ROGERS, of Madison, Ind.

ALL natural waters contain more or less mineral matter. This is acquired by contact with the earth's surface, and by percolation through its soil and rocks. It consists principally of carbonates of lime and magnesia, sulphate of lime, and chloride of sodium, in solution, and clay, sand, and vegetable matter, in suspension. The many other saline ingredients found in various waters exist in very small proportions, are generally very soluble, and therefore have no relation to the utility of waters in boilers. Of the above-mentioned salts, the carbonates of lime and magnesia are only soluble when the water contains free carbonic acid—consequently the waters of rivers, lakes, &c., contain them in less quantities than those of wells, springs, and creeks, owing to the precipitation caused by the spontaneous evolution of the solvent on exposure to air, heat, and light. Our American rivers contain from 2 to 6 grains of saline matter in the gallon, in solution, and a varying quantity in suspension, generally exceeding 10 grains. Well and spring waters hold but little in suspension but a quantity of the dissolved salts, varying from 10 to 650 grains in the gallon. When such water is boiled the carbonic acid is driven off, and the carbonates, deprived of their solvent, are rapidly precipitated in a finely crystallised form, tenaciously adherent to whatever they may first fall upon. Sulphate of lime requires 500 parts of water for its solution, and as the water evaporates supersaturation occurs, and the salt is precipitated in the same form and with the same adherent quality as the carbonates. Chloride of sodium and all the other more soluble salts are precipitated by the same process of supersaturation, but, owing to their greater solubility, much more evaporation is required. All suspended matter gradually tends to subside. This combined deposit, of which the carbonate of lime usually forms the greater part, remains adherent to the inner surface of the boiler, undisturbed by the force of the boiling currents. Gradually accumulating, it becomes harder and thicker, till it is as dense as porcelain, though tougher, and at length may obtain such a thickness as to prevent the proper heating of the water by any fire that can be placed in the furnace. The high heats, sometimes necessary to heat water through thick scale, will sometimes convert the scale into absolute glass by combining the sand with the alkaline salts composing it. The evil effects of the scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power compared with that of iron is as 1 to 37·5. Consequently more fuel is required to heat water in an incrusted boiler than in the same boiler if clean. A scale $\frac{1}{16}$th inch thick will require the extra expenditure of 15 per cent more fuel. This ratio increases as the scale is thicker. Thus when it is $\frac{1}{4}$ inch, 60 per cent more fuel is needed; $\frac{1}{2}$ inch, 150 per cent, &c. Abstractly then, to raise water in a boiler to any given heat, the fire-surface of that boiler must be heated to a temperature according with the thickness of the incrustation in an increasing ratio. To illustrate—to raise steam to a pressure of 90 lbs., the water must be heated to about 320° F. In a clean boiler of $\frac{1}{4}$ inch iron this may be done by heating the external surface of the shell to about 325°. If $\frac{1}{4}$ an inch of scale intervenes between the shell and the water, such is its non-conduction that it will be necessary to heat the fire-surface to about 700°, almost low red-heat. Now the higher the temperature at which iron is kept, the more rapidly it oxidises, and at any heat above 600° it very soon becomes granular and brittle, and is liable to bulge, crack, or otherwise give way to the internal pressure. This condition predisposes the boiler to explosions, and makes necessary expensive repairs. Again, it is readily seen that the presence of scale renders slower and more difficult the raising, maintaining, and lowering of steam.

To obviate the evils arising from incrustation, many methods have been devised to prevent and remove it. For this purpose picking, scraping, cleaning, &c., are very generally resorted to. Such is its toughness and tenacity, however, that this only partially succeeds, and is moreover expensive in time and money, since it is generally necessary to lose a working day in the operation. Various mechanical contrivances have been introduced, intended to intercept the precipitated saline matter from the supply water on its passage through the heating apparatus. They consist essentially of a series of obstructions to the flow of the water. After it has been heated almost to boiling by the exhaust steam, the carbonates are precipitated, and subside upon the shelves, straw, and other obstructions, over which the water flows. This plan, however, only partially fulfils the purpose, since it only intercepts a portion of the carbonates and suspended matter. The soluble salts all pass on into the boiler, and a great portion of the dissolved carbonates also, which cannot be precipitated during the short passage through the heater. The scales form more slowly, but as surely. It is impossible to make such contrivances completely efficacious. No mechanical arrangement will suffice. To chemistry alone must we look for the desired means. For a long time simple chemical means have been used in an empirical way with some success. The *modus operandi* of some of these I will notice. Starchy matters—such as Indian corn, potatoes, oil-cake, &c.—prevent scale only by enveloping the precipitates with gelatinous matter, thus lessening their weight, causing them to float, and obviating their agglutination into solid masses. This application, however, tends to cause foaming or frothing of the water, making it impossible to determine the quantity in the boiler, and hence is objectionable.

* Abstract of a paper read before the American Association for the Advancement of Science at Indianapolis, 1871.

Molasses, fruits, cider, slops, vinegar, cane-juice, and a variety of other things, containing more or less acetic acid, placed in the boiler, convert the carbonates into soluble acetates. The sulphate of lime remains unaltered, however, and the iron being as much open to the attacks of the acid as the saline matter, the boiler is slowly, but surely, damaged.

Oak, hemlock, and other barks and woods operate by means of the tannic acid therein. Various extracts, such as catechu, logwood, &c., very rich in tannin, are also used. Tannic acid decomposes the carbonates, but, unlike the acetates, the resulting tannates are insoluble. Their specific gravity, however, is low; they float in the currents of ebullition, and, having no tendency to adhere, do not agglutinate into a mass, and cannot form a scale. The sulphates and chlorides are not acted upon at all by the tannic acid, and will incrustate notwithstanding its presence. Tannin, as offered in the above-named agents, is left free to act upon the iron, and will, after a time, exhibit its damaging effects on the boiler.

The fixed alkalies are much used for this purpose, in the various forms of lye, ashes, carbonate of soda, caustic soda, potash, &c. These agents decompose the sulphate of lime, sulphate of soda or potash and carbonate of lime being the results. The first is held in solution, the latter is precipitated, but in larger crystals, which do not form so refractory a scale as ordinarily. The carbonates of lime and magnesia are also precipitated by these agents, the free carbonic acid being taken to form carbonates or bicarbonates of soda or potash; the chlorides are not affected. This method simply modifies the form of the precipitate, and consequently the quality of the scale, without affording any means for its prevention, and therefore deserves but little attention. Ammonia and its carbonate have a precisely similar action, and the same objection stands against them. These alkalies have no chemical action on the boiler, but rather tend to preserve it, inasmuch as they prevent the free carbonic acid from combining with the insoluble crust of oxide of iron (formed by contact with the water) to form a soluble carbonate of iron, which, being dissolved away from the iron, would leave a surface constantly exposed to fresh action. Chloride of ammonium is another means employed. This has its action only on the carbonates of lime and magnesia. The reaction produces carbonate of ammonia, which, being volatile, passes off with the steam, and chlorides of calcium and magnesium, both very soluble. This is an efficient way of removing old scale. Its only objection is the ammoniacal odour of the escaped steam.

The foregoing are methods in which a single agent is used. They are frequently combined with a view of obviating the mentioned objections. Starch, tannin, and soda constitute the basis of most of these combinations. Crude petroleum is also used with reported partial success. The *rationale* of its action is not well understood, owing to the complexity of its chemical constitution. There are many proprietary compounds at present in use composed essentially of these elements, generally, however, with the addition of other things, introduced for the purpose of disguising their composition. Besides these, many other preparations are before the public which have been patented, all having a general resemblance, inasmuch as tannin, starch, and soda are the principal ingredients, in some form. Gum catechu is most generally the tannin-bearing body; sal soda, the alkali; and flax-seed, oil-seed cake, bran, or coarse flour the starchy element. In most of those which I have examined these very useful agents have been simply mixed empirically, without regard to chemical laws, and they generally contain more or less free tannic acid, and a considerable amount of inert, insoluble vegetable matter, which tends to produce foaming, besides being useless. Besides these methods, in which the chemical agents are introduced directly into the boiler, others have been devised, in which the waters are depurated, by chemical means, before entrance into the boiler. Clark's process consists in the precipitation of the carbonates with milk of lime, the free carbonic acid being taken up; the sulphate of lime remains in solution. Another method, proposed by myself, consists in converting the earthy carbonates into soluble chlorides by hydrochloric acid, and neutralising the excess of acid by filtration through carbonate of baryta (witherite) in coarse powder. The soluble chloride of barium thus formed decomposes the sulphate of lime, chloride of calcium being kept in solution, and the sulphate of baryta being deposited insoluble. This method recommends itself for railway water stations, on account of its cheapness and simplicity.

Oxalic acid may be used very efficiently for the complete precipitation of all the lime salts as insoluble oxalates, but the expense might be a bar to its use. Tannic and acetic acids, the excess being properly neutralised by carbonate of soda, may also be used for tank depuration.

These tank methods, however, cannot influence to any great extent the scale already formed; and as the removal of this is as needful as its prevention, it is palpable that that method is best for general application which attains the complete removal, as well as prevention, by chemical means operating inside the boiler.

Having this end in view, the writer has proposed two processes: one consists simply in the introduction into the boiler of a sufficient quantity of the oxalate of soda to cause the immediate decomposition of the scale-forming salts as they enter the boiler, converting them into insoluble oxalates, which are precipitated as a mushy sediment, which has no tendency to form scale, and which may be blown out from the mud-receiver, or otherwise voided. In the other process tannate of soda is the agent, kept constantly present in the boiler in solution; it decomposes the carbonates of lime and magnesia as they enter, tannates being precipitated in a light, flocculent, amorphous form, so that they do not subside at all in the boiler, but are retained in suspension by the boiling currents until they find their way into the same receiver, when they settle into a loose, mushy mass, which may be easily blown out from time to time. The carbonate of soda formed in the reaction is retained in solution, becoming a bicarbonate by appropriation of the free carbonic acid in the water. This decomposes the sulphate of lime, the resulting sulphate of soda being retained in solution, and the carbonate of lime being acted upon by fresh portions of the tannate of soda as above. The constant presence of the alkali protects the iron from all action, either of the carbonic or tannic acids. The same reactions take place between the tannate of soda and the already existing scale with like results, but more slowly, some weeks being generally required, in practice, in removing the deposit, if it exists in any considerable quantity.

Portions of scale are detached, from time to time, which may be removed at the usual cleanings, which should be made at short intervals, when possible, until the boiler is entirely clear of all incrustation, after which this will not be necessary. Extensive practical trial of this process for two years has demonstrated its utility for all varieties of boilers. It is economical, easy of application, and generally adaptable. It may be used in marine boilers as well as those using fresh water, since the marine scale is almost identical with that formed in boilers using ordinary waters, consisting almost entirely of the carbonates of lime and magnesia and sulphate of lime. The chloride of sodium forms a mushy deposit, but is only incorporated in the scale to a slight extent.

University of London.—The following is a list of the candidates who have passed the recent D.Sc. Examination:—*Branch* VI. Electricity.—Alexander Muirhead, University College. *Branch* IX. Animal Physiology.—Henry Newell Martin, M.B., Christ's Cambr. and University.

ON A RELATION BETWEEN THE CHEMICAL GROUPING OF CERTAIN ELEMENTS, AND THE QUANTITIES IN WHICH THEY EXIST UPON THE EARTH'S SURFACE.

By JOHN A. R. NEWLANDS, F.C.S.

If a list be made of the fourteen principal elements which occur on the earth's surface (including the ocean and the atmosphere) in the largest quantities, which are also most widely distributed, and which appear essential to vegetable or animal life, it will be observed that they comprise two representatives of each of the chief chemical groups. Thus we have—

1. Hydrogen and chlorine.
2. Sodium and potassium.
3. Magnesium and calcium.
4. Aluminium and iron.
5. Carbon and silicon.
6. Nitrogen and phosphorus.
7. Oxygen and sulphur.

Hydrogen and chlorine are here classed together on account of their mutual replaceability, with but slight change of properties, in many chemical compounds, such as trichloracetic acid, &c. The position, too, of hydrogen in the list of elements, when arranged in the order of atomic weights, indicates that it is really the lowest member of the chlorine group.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 10).

I shall now call your attention to a very remarkable discovery, recently made by the late Professor Bolley, viz., the conversion of purpurine into alizarine. If purpurine is heated in the atmosphere, as stated above, it is nearly all sublimed, leaving only a small amount of carbonaceous residue, but if heated in sealed tubes, at a temperature of 400°, it forms a carbonaceous mass, from which water extracts alizarine. Under the influence of the high temperature, the purpurine loses an equivalent of oxygen, and is converted into alizarine. This reaction appears to confirm the opinion of M. Decaisne, that the madder plant contains only one colour-giving principle, which under the oxidising influence of the atmosphere becomes converted, first, into alizarine, then purpurine, and afterwards into the still more highly oxidised compounds.

The difficulty and expense experienced by calico-printers in brightening their colours, and obtaining pure whites in madder-dyed goods, attracted many years ago the attention of scientific and practical men, and any process by which these difficulties might be overcome was anxiously looked for. The discovery of MM. Robiquet and Collins, that the colour-giving principle was not destroyed by sulphuric acid, was the step in that direction, and led M. E. Schwartz to observe that the carbonaceous mass of Robiquet, if carefully washed and neutralised, could be used as a dye-stuff. MM. Lagier and Thomas improved upon this, and introduced, in 1839, an article which is now extensively used by calico-printers and named garancine, and now is prepared as follows:—Madder, either unwashed, or, better still, washed with cold water, is mixed with one-third of its weight of sulphuric acid which has been previously diluted with water till it marks 10° Twaddle; it is then boiled for four or five hours, and the mixture run on to woollen filters, and washed till only a mere trace of acid remains. It is then either removed or washed once with a very weak solution of carbonate of soda, submitted to hydraulic pressure, and then introduced into drying stoves. One hundred parts of madder yield from 34 to 37 of garancine. Garancine is a fine powder, of a light brown colour, and has a dyeing power four times as great as the original madder. It does not give as good blacks as madder, nor are its purple, red, and pink so fast, but its purple is brighter, and the whites are obtained pure without soaping, it being only necessary to substitute a slight clearing liquor, composed of an alkaline hypochlorite of soda, to which is added a small portion of sulphate of zinc.

In 1852, Messrs. Pinckoff and Schunck effected an improvement in the manufacture of garancine, their product being known in England under the name of commercial alizarine; but on the Continent it is better known as *Pincoffine*. Their process consists in submitting ordinary garancine to the action of high pressure steam of a temperature of 300° F., which, whilst it does not act on the alizarine contained in the garancine, destroys two other colouring matters which are present. These Dr. Schunck has isolated and examined, and named *Rubertine* and *Rerantine*. They are of a peculiar resinous nature, and spoil both the whites and the purples, which are fixed along with alizarine in the dyeing process. The employment of commereial alizarine is especially advantageous in the production of purples, which are faster and more brilliant than those produced by ordinary garancine. The cloth also does not require either soaping or cleansing.

M. Pernod, has, within the last two or three years, introduced a madder extract, which is at the present time extensively used in Lancashire as a topical colour. This term is applied to a colour which is printed on a fabric, and afterwards fixed by steaming. By this method bright and fast colours are introduced in printed goods, producing much more effective designs than could be effected if the goods had to pass through a dye-beck and afterwards be washed with large quantities of water. Some splendid specimens of this class of printing were to be seen at the Universal Exhibition, 1867.

To prepare the extract, garancine is lixiviated till completely exhausted, with a nearly boiling solution of sulphuric acid, containing five parts of acid to a thousand of water. On cooling, an orange-red precipitate falls to the bottom of the vessel, which, when collected and thoroughly washed, constitutes an extract ready for use. The products of M. Leitenberger and Messrs. Schaaffer and Lauth may be substituted for this extract.

As the employment of these extracts is the most important improvement recently introduced into calico printing, I will give the three following recipes for their application:—To produce dark red, take 8 lbs. of extract of madder, 4 lbs. acetic acid, and 1¼ lbs. starch. Boil these in an earthenware vessel, and when cold add to six measures of the above one of acetate of alumina and a very small quantity of Gallipoli oil, say one per cent. For a pale red, take 4 lbs. of extract of madder, 2 lbs. of acetic acid, 10 quarts of gum Senegal water, and 1 pint of acetate of alumina. To obtain a purple, take 1 pint of extract of madder, half pint of acetic acid, half pint of water, and 3 ozs. starch; boil, and when the mixture is cool, 5 ozs. measure of acetate iron of 24° Twaddle, and 5 ozs. of water. To produce a chocolate, proceed as in the last recipe, substituting acetate of chrome for the acetate of iron.

The above mixtures are printed on cloth by means of engraved copper rollers, and are then dried and submitted to dry high-pressure steam for one or two hours, when the colours have become fixed on the fabric. After being slightly soaped, to remove all excess of colour, the prints are stiffened, and ready for the market.

Although I have now concluded my lecture on madder as a dye-stuff, and have already exceeded the time allotted

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

to me, I hope you will allow me a few minutes more, to enable me to give an outline of the processes by which madder styles are produced, the more so as there may be some persons present who are not aware how madder and garancine prints, now manufactured in such enormous quantities and in such general use, are produced.

To effect this, the ordinary white calico, as sold in shops, is not sufficiently deprived of its impurities to be employed in madder or garancine styles; it has therefore to undergo further bleaching operations. The calico so extra bleached is then printed by means of copper rollers, on which the pattern to be produced is engraved. This roller leaves on the calico a red, purple, or chocolate mordant; that is for red, a sulpho-acetate of alumina, or red mordant; for purples, violets, and blacks, an impure acetate of protoxide of iron, known in the trade as pyrolignite of iron, or black liquor; and for chocolates a mixture of these two mordants.

After this operation the pieces undergo a process technically termed ageing. This was formerly effected by spreading out the pieces, and hanging them in a room for three or four days, so that the acetate of alumina might lose part of its acetic acid, and the iron mordant nearly the whole of it, thus liberating the oxide of iron and enabling it to undergo partial oxidation.

Some few years ago, Mr. David Thom introduced a process by which this is effected in twenty minutes; it consists in passing the printed mordanted cloth over rollers fixed in a machine placed in a chamber about twenty feet long, in which a current of air and steam is thrown. The temperature of this chamber must not be below 100° nor above 108°, and the quantity of steam present must be such that 50 yards of calico will take up one ounce of moisture during the twenty minutes it takes to pass through the chamber. The printer is able to test the state of the chamber by means of wet and dry bulb thermometers. The next operation to which the cloth is submitted is dunging. The process received this name because formerly the calico was passed through a mixture of cow-dung with water. Now, however, silicates or arseniates of soda, mixed with a little chlorate of potash, are substituted. After passing through either of these solutions they are washed, and ready to be passed through the dye-beck. This beck contains water, and from five to seven pounds of madder, or one to two and a half pounds of garancine, or commercial alizarine, for each piece of calico to be dyed. The heat of the bath is then gradually raised, by means of a jet of steam, to 180° for garancines, or 212° for madders. This operation takes from one and a-half to two hours, according to class of goods, style, &c. The fabrics are then washed and passed through a cleansing liquor for garancine or commercial alizarine styles, or soaped twice at 180, when they are dyed with madder.

The most permanent and brilliant colour produced from the *Rubia* plant on cotton fabrics is Turkey red. The details so essential to success in dyeing this colour are kept by each dyer a secret, but I will attempt, as briefly as possible, to give the main features of the process. After the bleaching of the fabric is completed, they are passed through Gallipoli oil, and then exposed to the atmosphere in heated chambers. This operation is repeated several times. The next one consists in passing the cloth through a weak alkaline solution. After this they go through a solution of acetate of alumina, and then through a bath of a tannin substance. By these processes, no doubt, the fatty acids of the oil combine with the alumina, as does the tannic acid of the tannin matter, helping to fix the mordant in the fibre of the fabric. On being dyed, the goods assume a rich, dark red tone, to which briliancy is imparted by passing the dye fabric through heated soap solutions.

I should occupy too much of your time were I to attempt to enter into the details of the methods by which chemists determine the relative tinctorials powers of roots, madders, and garancines, but I may give you a very simple method of detecting ordinary adulterations of garancine by dye woods and tanning matters. Pieces of blotting paper are dipped into a weak solution of chloride of tin and sulphate of protoxide of iron, and on each of these sheets is sprinkled a little of the suspected garancine. If a dye wood be present, the chloride of tin paper will assume a red colour, and if tannin matter be present, the iron paper will be blackened.

(To be continued).

NOTICES OF BOOKS.

Notices on Nuisances, Drains, and Dwellings. By W. H. Penning, F.G.S. London: Baillière and Co.

Mr. Penning tells us that his pamphlet was written during a period of incapacity for his usual avocations, and most sincerely do we wish that such periods could be so usefully employed. The author deals with sewer-gas, the escape of ordinary gas, decaying organic matter, damp, and smoke as nuisances, giving subsequent chapters on ventilation, air-shafts, and the general prevention of nuisances. The remarks show much common sense, and are easily applicable.

Notes of Fifteen Lectures on "Physics and Chemistry." Delivered by Professor Guthrie, in the Lecture Theatre of the South Kensington Museum during January and February, 1872.

These are the notes of lectures delivered in the course of instruction in Science and Art for Women by Professor Guthrie. Quietly pursuing course after course of lectures, Dr. Guthrie has done and does more for the advancement of science than many whose names are daily before the public. In these notes we have the sum of this department of Professor Guthrie's work. To the lecturer, the teacher, and the student of chemistry and physics the notes will be most valuable; to the lecturer and teacher they will afford a basis of discourse; to the student they will prove an admirable means of self-examination. In the recapitulation or "Gossip" on his lectures, Professor Guthrie speaks with the greatest point. Says he—"The heavenly bodies in their orbits are types of the particles of matter which we handle. Call these small parts particles if you please, or call them molecules, but do not call them atoms: do not write '*finis*' to the book of nature." Most sincerely is Professor Guthrie to be congratulated on the successful issue of his work at South Kensington.

Index to Gmelin's Handbook of Chemistry. By Henry Watts, B.A., F.R.S., F.C.S., Editor of the "Journal of the Chemical Society." London: Harrison. 1872.

Every chemist will rejoice to learn that the Index to "Gmelin" is published. We need not dwell upon the advantages of the possession of a complete series of this admirable and exact work, for the volumes are generally regarded as indispensable to the shelves of the chemist. So great is the demand that several of the volumes are out of print, and others are very scarce. It being probable that now the Index is published there will be a call upon the later volumes of the work, we recommend our readers to order their copies at once to prevent disappointment. The concluding volume (the 18th) and the Index, are included in the subscription to the Cavendish Society for the year 1864. It need not be said that the arrangement of the Index is thoroughly logical, every compound being taken under as many heads as possible to facilitate reference. The employment of Arabic numerals, but in different types, in referring to both volume and page, is much to be commended as preventing confusion. In a word, the announcement that the work is complete, will be deemed in our pages a sufficient notice.

CORRESPONDENCE.

PROPOSED ASSOCIATION OF MANUFACTURING CHEMISTS.

To the Editor of the Chemical News.

Sir,—As manager of one of the largest chemical works in Lancashire, may I express the great gratification with which I have read the two able letters of your correspondents, and your own clear and cogent exhibit of reasons in favour of an association of manufacturing chemists. To illustrate how one manufacturer may communicate valuable information to another without being any the poorer for it, perhaps you will allow me space for the following brief statement of fact:—There is an extensive chemical manufacturer in this district, who has just re-leaded, and divided into smaller ones, two immense vitriol chambers: the legacy to him of a time when everybody built them of enormous size. As each of these large chambers represented one-third of his entire chamber capacity, the simple result was that, by the dislocation, his manufacturing power was reduced one-third, while, at a ruinous cost, he had to buy vitriol to make up the deficiency during the whole time of the repairs. Of course the stoppage and repair of a chamber one-fourth the size of these would only have reduced his producing calibre one-twelfth—a mere bagatelle. One would think that considerations like this would be patent to the merest tyro in scientific manufacturing; but they are not, for—influenced solely by the relatively paltry object of saving lead—owners of works are still to be found putting up chambers of very large size. I conclude by remarking that if any intending vitriol maker is guided in his erections by what I have said, he may save many hundreds of pounds by what has cost me only

Pen and Ink.

To the Editor of the Chemical News.

Sir,—It may seem strange for an engineer to express an opinion upon the proposal for an association of manufacturing chemists, but I have long had an opinion that such an association would benefit all concerned. I only hope that should such a society be formed, membership will not be limited to the profession strictly.

One can hardly exaggerate in statements as to the difficulty of obtaining reliable information on chemical matters, more especially as to the quantity of work performed in plants of certain size and the cost of the said work. In answer to enquiries and questions, I have had replies so widely different from divers persons that I am obliged to suppose some of them have been concocted for the express purpose of misleading.

Of course no society can exist successfully unless the members from the outset studiously avoid all attempts at concealment or misleading; and, on the contrary, endeavour to exchange ideas as much as possible.—I am, &c.,

Thos. Wilkins.

Adelaide Chambers, 52, Gracechurch Street,
July 6, 1872.

PS.—Re Coffey's stills for ammonia. About four or five years ago Messrs. Packard, of Ipswich, erected one at their Bramford works; it was working one or two years to my knowledge, and may still be so.

The description in Muspratt is hardly correct in detail, and is likely to mislead. I shall be pleased to give your correspondent what information I can, having had to do with these stills for the distillation of spirits, &c.—T. W.

To the Editor of the Chemical News.

Sir,—I am very glad to be able to endorse the feeling in "Frank's" letter of last week but one. Such a society as he proposes should surely soon be got together and in working order; and I would propose Manchester as a centre for the local society of Lancashire manufacturers. That it would be of great benefit to its members can scarcely be doubted. The old days when manufacturing *chemists* were, the bulk of them, simply a set of quacks and dabblers in drugs are over, or at any rate nearly so, and with them have gone most of the petty jealousies and paltry pickings and stealings of secrets, mean spying, and all the other offspring of the then state of ignorance (it is no longer a reproach to be called a theoretical chemist). I myself have perceived what must have made itself apparent to many others, that a much better and healthier tone has arisen within this last twenty years. A conversation with a fellow manufacturer or manager is no longer a fencing match—an attempt to acquire the largest amount of information, at the same time imparting as little as possible. There is much knowledge of such a general kind that can be imparted without at all impoverishing the giver. It makes no one the poorer to say the size and strength of the timbers for a vitriol chamber, or how much sulphur or pyrites he burns for a given chamber space: all this forms simply common gossip. The Literary and Philosophical Society of Manchester only partly serves "Frank's" object; its tone is more high science, with only comparatively a sprinkling of technology, whereas the proposed society, I take it, would confine itself to questions of a technical bearing only. In conclusion, I can only add that I shall be glad to render all the assistance I can in carrying out the movement.—I am, &c.,

Peter Hart.

Ardwick Bridge Chemical Works,
Manchester.

THE CAVENDISH SOCIETY.

To the Editor of the Chemical News.

Sir,—As one who has benefitted by the publications of the Cavendish Society, and desires a continuance, I wish to know if there is any reason why it is not, as in years gone by, busily engaged in the translation and publication of English and foreign works treating of the various branches of the science studied with such lasting effect by him whose name it bears? Is it that its object is now less important than it was at its foundation? Are there not now-a-days works published—or which would be published if any sufficient inducement were offered—here, on the Continent, and in America, of equal sterling worth to those published hitherto by the Cavendish Society, which remain either entirely, or to a great extent, unknown to us in Britain for want of some such Society to carry on this work? Or is it, that though the object is as important as ever, and the material as abundant, the society must be dissolved for lack of funds?

The above, it appears to me, are the main reasons why such a society should be allowed to decline, and none of them I am persuaded, nor all combined, are of such weight at the present time as to render it necessary to give up the Society altogether. Perhaps some of those concerned in the management may be able to furnish reasons why it has sunk to such a low ebb; but is it not a matter to be urged upon the consideration of the Council—if such still exists—to revive, and re-model as far as necessary, the existing society, and to continue the good work which it has so well done in the past?

Are there not some of the works of its founders and officers,—Faraday, Graham, Hofmann, Daubeny, Miller, Stenhouse,—as well as others, which are so scarce that their publication by the Society would be a boon to many, and which would remunerate the Society for its trouble in publishing them?

Mr. C. Tomlinson, in his letter of January 24, 1870 (Chemical News, vol. xxi., p. 44), spoke of the dissolution of the Society on Messrs. Harrison having com-

pleted the publication of the works in hand. Perhaps he, or Mr. Watts, will favour us through your columns with the views of the Council on these points, and it is to be hoped that by bringing the matter before your readers their attention may be arrested, and the result may be such expressions of opinion and interest as will lead to the resuscitation of this useful Society. That such may be the case is the wish of—Yours truly,

W. H. WOOD.

Halifax, July 5, 1872.

MISCELLANEOUS.

Royal School of Mines.—At a meeting of the Council held on July 6, the Associateship was conferred on the following gentlemen:—Mining and Metallurgical Divisions—O. Pegler, W. Charlton. Mining and Geological Divisions—G. M. Dawson. Mining Division—E. Dillon. Metallurgical Division—F. W. Harrold, J. H. Huxley, O. F. Monday, A. G. Phillips. The following awards were made:—First year students—The two Royal Scholarships, £15 each, to Mr. S. A. Hill and to Mr. J. Taylor. Second year students—H.R.H. The Duke of Cornwall's Scholarship to Mr. Edgar Jackson, the Royal Scholarship of £25 to Mr. C. Law, and the Murchison's Medal and Prize of Books in Geology to Mr. S. W. Davies. Third year students—The Edward Forbes's Medal and Prize of Books in Natural History and Palæontology to Mr. G. M. Dawson. The De la Beche Medal and Prize of Books in Mining to Mr. W. Charlton.

New Quicksilver Assay.—The following description of a new method of assaying quicksilver ores, by A. Eschka, is taken from the *Berg-und huttenmannische Zeitung*. The new assay may be used for cinnabar, mercuriferous Fahlerz, &c. The ore should be weighed in a balance turning with one milligramme. The quantity of ore for the assay varies according to its richness, as follows:—

Ore containing up to	1	per cent		10
,,	1 ,,	10 ,, ...		5
,,	10 ,,	30 ,, ...		2
,,	over	30 ,, ...		1

The ore is introduced into a porcelain crucible, the edge of which has been ground flat, and mixed with about half its weight of clean iron filings, by means of a glass rod, and is then evenly covered with a layer of iron filings about ¼ to ⅜ inch thick. A concave cover, made of fine gold, about 2 inches in diameter and 12 to 15 grammes in weight, is now placed on the crucible after having been carefully weighed; the concavity is filled with distilled water and the crucible placed on a triangle and heated for ten minutes by a Bunsen burner or Argand spirit-lamp, during which time the mercury is volatilised and deposits itself on the gold. The gold cover is then removed, the water poured off, and the mirror of mercury on the convex side washed with alcohol from a wash bottle. After being dried in the water-bath the cover is allowed to cool thoroughly, and is then weighed in a balance turning with ½ milligramme with 50 grammes in the pan. The increase of weight gives the quantity of quicksilver in the ore. During the weighing the cover is placed on an empty porcelain crucible. The quicksilver is then driven off by heating the cover gently in the flame of a Bunsen burner or a spirit-lamp, in a place where there is a good draught, and the empty crucible and cover are subjected to a second weighing as a check. In order that the assay should succeed the following conditions must be fulfilled:—The cover must fit closely, so as to avoid loss of quicksilver, and must be deep enough to hold a sufficient quantity of water to keep it cool. The iron filings must be free from grease, which would prevent the proper formation of the mirror; the washing with alcohol must not be omitted, as it removes all the bituminous substances, which spoil the mirror and assist the drying; drying in a water-bath for two or three minutes; cooling in the exsiccator; weighing when fully cool. When assaying rich ores the alcohol used in washing the cover must be collected, as it may contain a little amalgam; it must be poured into the concavity of the cover, which will take up any little globules of quicksilver. The most exact results are obtained in the case of poor ores containg less than 10 per cent.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, June 10, 1872.

In addition to several important papers relating to mechanical, mathematical, and natural history sciences, this number contains the following papers more particularly bearing upon chemistry:—

New Method of Printing upon Woven Tissues by means of Metallic Precipitates.—E. Vial.—The author describes, at considerable length, a peculiar process of printing upon woven tissues, by first impregnating the same with a solution of nitrate of silver, or of any other metallic salt which, on being brought into contact with either metallic zinc or copper, is so decomposed as to set the metal free, and next printing on the tissue so treated a pattern by means of zinc or copper plates; the result being that, wherever contact between the metal and tissue (treated as just mentioned) takes place, there is formed a precipitate of the metal (silver, in case the woven fabric were impregnated with nitrate of silver), which is at once indelibly fixed to the cloth, presenting, according to the strength of the silver solution employed, a colour varying from a bright grey to an intense black. The colour is exceedingly fast, resisting the action of alkalies, acids, and soap.

Researches on the Trichloracetates.—A. Clermont.—After briefly referring to his former researches on this subject (see CHEMICAL NEWS, vol. xxv., p. 202), the author describes—Acid trichloracetate of ammonia, $NH_4O,HO,2(C_4Cl_3O_3)$. This salt is not decomposed at the ordinary temperature of the air, but on being heated it gives off trichloracetic acid, while chloride of ammonium is formed. 100 parts of the salt contain—Ammonia, 7·55; trichloracetic acid, 89·82; water, 2·63. Acid trichloracetate of thallium, $TlO,HO,2(C_4Cl_3O_3)$, a beautifully-crystalline salt obtained by dissolving carbonate of thallium in an excess of trichloracetic acid. 100 parts of this salt consist of—Oxide of thallium, 40·0; trichloracetic acid, 58·30; water, 1·70. Neutral trichloracetate of thallium, $TlOC_4Cl_3O_3$, also a crystalline body, contains, in 100 parts—Oxide of thallium, 57·84; trichloracetic acid, 42·16. As regards the action of permanganate of potassa upon hydrate of chloral, it appears that the salt just alluded to oxidises hydrate of chloral very energetically, the result being the formation of trichloracetic acid, which remains in the liquid combined with potassa.

June 17, 1872.

This number contains the two following papers relating to chemistry:—

Combination of Stannic Acid with Anhydrous Acetic Acid.—M. Laurence.—By heating to 150°, in a sealed tube, a mixture of 2 parts of anhydrous acetic acid and 1 part of meta-stannic acid, previously dried at 100°, there is obtained a syrupy liquor, which deposits, on cooling, long needle-shaped crystals. On being first roughly dried between folds of filtering-paper, and then in vacuum, they lead, on analysis, to the following cyphers, in 100 parts:—Tin, 33·33; acetyl, 48·58. Formula—

$$SnO_2\left[\begin{matrix}(C_2H_3O)\\(C_2H_3O)\end{matrix}O\right]$$
$$Sn_2O_4\ (C_{16}H_{12}O_{12})$$

When the same crystals are washed with anhydrous ether until that fluid takes up no more acid, and the substance is again dried in vacuum, the percentical composition is the following:—Tin, 46·82; acetyl, 34·1. Formula—

$$SnO_2\begin{matrix}(C_2H_3O)\\(C_2H_3O)\end{matrix}O$$
$$Sn_2O_4(C_4H_6O_6)$$

When the crystals are exposed to air, they become amorphous and

exhibit a vitreous mass, which, on being analysed, led to the following results:—In 100 parts—Tin, 56·19; acetyl, 21·0. Formula—

$$SnO_2\left(\begin{matrix}C_2H_3O\\H\end{matrix}\right)O$$
$$Sn_2O_4(C_4H_4O_4)$$

New Phospho-Platinic Compound derived from Toluidine.—G. Saillard.—After first referring to Dr. Schützenberger's researches on phospho-platinic compounds, the author states that, by heating an alcoholic solution of the ether, $Ph(C_2H_5O)_3PtCl_2$, with an excess of crystallised toluidine, there is obtained a product which, after having been purified and dried at 100°, yields, on analysis, the following percentical results:—Ph, 5·73; C, 28·83; H, 4·43; N, 2·59; Pt, 36·43; Cl, 13·12. The reaction which takes place is exhibited by the following formula:—

$$Ph(C_2H_5O)_3C_7H_9NPtCl_2+KHO=$$
$$=2KCl+Ph(C_2H_5O)_3C_7H_9NPt(HO)_2.$$

This number contains some very important papers and memoirs bearing upon meteorology, astronomy, natural history, and geology.

La Revue Scientifique de la France et de l'Etranger, June 22, 1872.

This number, delayed in transmission, contains no original papers relating to chemistry, but we may call attention to the following important memoir:—

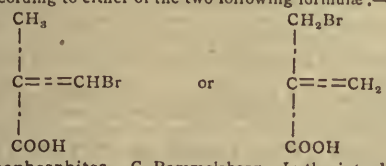
Civilisation Considered as Accumulated Force.—L. Dumont.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 11, 1872.

This number opens with an admonition on the part of the treasurer of the Society, whereby the members are reminded that, in accordance with section 23 of the statutes, any member who, after having been twice requested in writing to pay his contribution, fails to do so, ceases to be a member *hoc ipso facto*, and his name is peremptorily struck from the roll.

The following original papers and memoirs are contained in this number:—

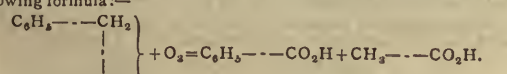
Isobutyric Acid from Citra-bibrom-pyrotartaric Acid.—F. Geromont.—The main gist of this short paper is that, according to the researches of Kekulé, the acid obtained by the action of sodium amalgam and water upon citra-bibrom-pyrotartaric acid must be constituted according to either of the two following formulæ:—



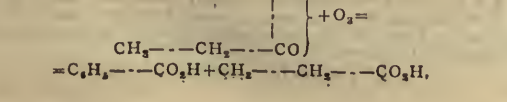
On Hypophosphites.—C. Rammelsberg.—In the introduction to this lengthy memoir, the author reviews the labours of Dulong, H. Rose, H. Davy, Würtz, and others on this subject. The mode of decomposition of the salts alluded to, when exposed to the action of heat, is then discussed at great length. It appears that in some cases the result of the decomposition of hypophosphites by heat is the formation of a mixture of pyro- and meta-phosphate. The hypophosphites of nickel and cobalt leave, on ignition, a mixture of meta-phosphate and phosphuret of the metal. Hypophosphite of ammonium yields, on ignition, 1 molecule of pyrophosphoric, and 2 molecules of meta-phosphoric acids. The hypophosphite of uranium is converted into phosphate of protoxide of uranium, a conversion attended with explosion, in consequence of the sudden evolution of hydrogen gas.

Most Simple Method of Determination of the Molecular Weight as Deducted from the Volume of Vapour.—H. Landolt.—This paper is illustrated with a woodcut, the reproduction of which would be essentially required for the proper understanding of the contents.

Oxidation-Products of the Benzyl-Ketons.—A. Popoff.—In the introduction to this essay, the author discusses the general principles of the oxidation of the benzyl-ketons, and next treats on benzyl-methyl-keton, which, having been obtained in a state of perfect purity, and exhibiting all the properties described by Radziszewsky, was oxidised by means of bichromate of potassa and sulphuric acid, yielding benzoic and acetic acids. This oxidation took place according to the following formula:—



Benzyl-ethyl-keton, having been prepared, was also oxidised, the result being the formation of benzoic and propionic acids. This reaction is elucidated by the following formula:—



Concentration of Sulphuric Acid.—R. Hasenclever.—Reserved for full translation.

Heat of Formation of the Nitrogen Acids.—J. Thomsen.—This paper is a criticism of the labours of Berthelot on this subject.

Contribution to our Knowledge on Cholesterin.—W. Loebisch.—This essay treats on—The products of oxidation of cholesterin, viz., a new acid, $C_{24}H_{40}O_6$, a solid, crystalline body, readily soluble in alcohol, ether, and warm acetic acid; acetyl-cholesteryl, also a solid crystalline compound, formula—

$$C_{26}\left(\begin{matrix}C_2H_3O\\H_{43}\end{matrix}\right)O;$$

cholesterylamin, $C_{26}H_{43}NH_2$. The author quotes the cholesterin compounds in the following manner:—Cholesterin, $C_{26}H_{43}.OH$ sodium-cholesterylat, $C_{26}H_{43}.ONa$; acetyl-cholesteryl—

$$C_{26}H_{43}.OC_2H_3O;$$

chlorcholesteryl, $C_{26}H_{43}.Cl$; cholesterylamin, $C_{26}H_{43}.NH_2$.

Nitro Compounds of the Fatty Series.—V. Meyer and O. Stüber.—This, the second instalment of a lengthy monograph on this subject, is divided into the following sections:—Metallic derivatives of nitro-ethan; nitro-methan.

Absorption of Ozone in Water.—L. Carius.—The author has instituted a series of experiments from which it appears that ozone is measurably absorbed by water, and that in the commercially-sold ozone-water (at Berlin, Krebs, Kroll, and Co., manufacturers) there is really contained ozone (not nitrous acid or peroxide of hydrogen) to an amount of about 4·45 c.c. in 1000 c.c. of water at 0° and 0·76 m. barom.

Some of the Pigments and Dyes derived from the Aromatic Azo-Diamines.—Dr. A. W. Hofmann and A. Geyger.—This second portion of a monograph on this subject treats on—Safranine; chlorhydrate of safranine; platinum salt of safranine; the free base; nitrate of safranine; picrate of safranine; iodhydrate of safranine; sulphate of safranine. The eminent authors call attention to the curious coincidence of the formulæ of safranine, $C_{21}H_{20}N_4$, and Perkin's mauvein, $C_{27}H_{24}N_4$, stating that the latter might almost be considered as phenylated safranine, $C_{27}H_{24}N_4=C_{21}H_{19}(C_6H_5)N_4$. When safranine is boiled with aniline, a violet dye is obtained; and when treated with concentrated acids, safranine and mauvein yield the same reactions.

Les Mondes, July 4, 1872.

Native Vegetable Ink.—Rev. F. Moigno.—The author states that experiments are being made to acclimatise in Europe the *Coriaria thymifolia*, or ink-plant of New Grenada. The juice of this plant, locally termed *chanchi*, is at first of a somewhat reddish colour, but becomes intensely black in a few hours. This juice can be used for writing without requiring any further preparations; it corrodes steel pens less than ordinary ink, and has, moreover, the advantage of better resisting chemical agents. When the portion of America named above was under Spanish dominion, all public documents were written with chanchi, which was not removed from paper by sea-water.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, April 25, 1872.

Gas-Making Apparatus for Domestic Use.—M. Symer.—The detailed description of an apparatus suited for the manufacture of illuminating gas, more especially for use in dwelling-houses, country seats, railway stations, &c., situated at a great distance from public gas-works.

Newly-Devised System of Purifying the Condensation Water of Low Pressure Steam Engines.—MM. Cail and Co.—The authors first refer to the various methods now in use for purifying—that is to say, freeing from grease and oily matters—the condensed steam of the low pressure engines, so as to render the resulting water fit for use again as feed-water of the boilers. They next describe their invention, which mainly consists of a contrivance by which the water is agitated with benzoline (light petroleum oil), which dissolves the fatty matters, leaving the water in a pure state. The benzoline may be rendered, after having become saturated with fatty matters, fit for renewed use by distillation, while the fatty substances may be used for soap-making and other purposes. From the authors' experiments it appears that from 1-5th to 1 grm. of fatty matters per horse-power is daily taken up by the condensation water; benzoline of good quality can take up more than half its weight of fatty matters before becoming inactive; other liquid hydrocarbons may also be taken.

Note on the Native Calcareous Phosphates (Phosphorite) of the Département du Lot.—C. Mène.—This paper, illustrated by woodcuts exhibiting sectional views of the quarries, gives a detailed account of the exploitation of thia mineral, now carried on on a large scale.

Testing of Wine, Beer, and Vinegar.—Dr. Duclaux.—The author, briefly describing a system of testing the relative value of the liquids referred to, states that, when alcoholic or acetic liquids are caused to pass drop by drop from a narrow orifice, these drops are heavier in relation to the larger quantity of alcohol or acetic acid contained in the liquid under examination. Special apparatus are to be used for this method of testing.

Bibliography.—Under this heading we notice the following work:—"La Pomme de Terre sa Culture, son Emploi et sa Conservation," by M. E. Vianne, Paris.—A. Sagnier.—This work,

illustrated by woodcuts, is very highly spoken of. The author, an eminent agriculturist, treats the subject agriculturally as well as industrially.

May, 2, 1872.

Bone-Black Manufacture.—C. Mène.—The detailed account of the modes and process of bone-black preparation as carried on by MM. Dunod and Bougleux. This industry includes, besides bone-black for sugar-refining purposes, the manufacturer of empyreumatic oil, bone-grease, sulphate of ammonia, superphosphate of lime, bone-dust, bone-ash, and bone-black for paint and blacking purposes.

Description of Apparatus for the Preparation of Gases in Chemical Laboratories.—J. Salleron.—Illustrated by woodcuts. The author gives an account of well and strong made cast-iron apparatus suited for making oxygen, coal-gas, and other gases, which require a strong heat for their preparatiou.

Continuation of the Essay on Dynamometers.—C. Mène.

Liquefied (Condensed) Sulphurous Acid Gas for the Preservation of Beet-roots.—Ch. Tellier.—Sulphurous acid gas is condensed and forced into portable vessels made of cast-iron, and the liquid dispersed through the beet-roots, which are kept in pits dug in the field and covered by earth; the gas is liquefied on the large scale by the combined agency of pressure and cold.

Bromine Water as a Test for Phenol.—C. Mène.—When bromine water is added in excess to a weak aqueous solution of phenol, there is formed a yellowish white precipitate of tribromophenol; this reaction is so sensitive that 1 part of phenol (carbolic acid) in 43·70 parts of water, that is 0·0229-grms. to the litre, can be detected; in case of any doubt arising as to the nature of the precipitate, it is separated by filtration, washed, and put into a test-tube, gently heated along with some sodium amalgam; the liquid is then poured into a beaker-glass, and upon the addition of a few drops of dilute sulphuric acid the characteristic smell of phenol will be perceived, and the substance becomes visible in the shape of oily drops.

Bibliography.—Under this heading we meet here with a review from the pen of Dr. Pisani of the work—"Détermination Pratique des Minéraux," by M. E. F. de Kobell. Paris: J. Rothschild, 13, Rue des Saint-Pères. It appears that this small work is a highly valuable book both for chemists and mineralogists to aid them in rapidly and accurately ascertaining the nature of minerals.

NOTES AND QUERIES.

Parnell's Process for Estimation of Arsenic in Ores.—I should feel obliged if your readers could inform me where I may obtain full particulars of Parnell's process for estimation of arsenic in ores by means of chlorine, as briefly described in Crookes's "Select Methods of Chemical Analysis."—G. W.

TO CORRESPONDENTS.

C. A. Priestley.—Apply chlorine-water with a camel's-hair brush, and wash with distilled water.

W. Morgan Brown.—We are obliged for the copy of Lightfoot's "Chemical History and Progress of Aniline Black."

G. E. Davis, W. H. Wood, and W. E. Bickerdike.—Received with thanks.

W. W.—There is a good article on indigo in the English edition of Wagner's "Chemical Technology," just published by Messrs. J. and A. Churchill.

W. P.—Consult Watts's "Dictionary of Chemistry."

B. Westermann and Co. (New York).—We have just received a letter from these correspondents, from which we quote the following:—"In CHEMICAL NEWS, vol. xxv., p. 71, under the heading "Bibliography," you state the price of Knapp's "Technische Wandtafeln," 64 coloured plates, &c., as £6 10s., which is evidently a mistake, the price for each of those 64 plates being R. 2. 10 groschen, or 7s. English, if four are taken at once; single plates selling at R. 2. 25, or 8s. 6d. The entire collection of 64 plates would cost, therefore, at 7s. each, £22 8s., and not £6 10s." We hasten to rectify the error, which, however, was not ours, as we correctly translated the price from the German periodical.

BOOKS RECEIVED.

Experimental Chemistry. Founded on the Work of Dr. Stockhardt. By C. W. Heaton, F.C.S. Bell and Daldy.

Proceedings of the Newcastle-upon-Tyne Chemical Society.

Tenth Annual Report of Charles A. Cameron, Ph.D., M.D., City Analyst to the Corporation of Dublin.

Contributions to Molecular Physics in the Domain of Radiant Heat. By John Tyndall, LL.D., F.R.S. Longmans and Co.

The New Patent relating to the Sewage of Towns. By J. Brough Pow, Esq.

The Journal of the Iron and Steel Institute. Vol. I. 1872.

The Retrospect of Medicine. Edited by W. Braithwaite, M.D., and James Braithwaite, M.D. Vol. LXV., Jan.—June, 1872. Simpkin Marshall, and Co.

Report of the Committee appointed to Test Steam Boilers at the American Institute Exhibition. From Prof. R. H. Thurston.

A Handbook of Chemical Technology. By Rudolf Wagner, Ph.D. Translated and Edited from the 8th German Edition by William Crookes, F.R.S. With 336 Engravings. J. and A. Churchill.

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THE CHEMICAL NEWS.

VOL. XXV. No. 660.

ON THE DETECTION OF ORGANIC AND OTHER NITROGENISED MATTER EXISTING IN THE ATMOSPHERE.*

By ALFRED HUTCHISON SMEE, F.C.S.

In this communication the author describes a method which he has devised, and which he names "distillation by cold," by which he believes the detection and determination of ammonia aud other organic impurities existing in the atmosphere will be greatly facilitated.

A glass funnel (usually of 8 or 9 inches) is drawn to a point and closed. It is supported in an ordinary stand, and filled with ice. Condensation of the watery vapour of the atmosphere then takes place; the dew collects into drops, which trickle down the outside of the funnel, and at last fall from the point, under which a small receiver is placed to catch them. The total quantity of liquid collected in a given time is measured, and the quantity of ammonia determined by Nessler's test.

By the method of distillation by cold, the author found it possible to distil many substances which are decomposed at a high temperature. Thus many delicate odours of flowers were distilled by placing the flowers under a bell-glass sufficiently large to cover the funnel containing the ice. The odours were found to be more rapidly and completely abstracted by placing a dish with a little ether under the bell-glass at the time of distillation.

The Paper was accompanied by tables giving the results obtained in 107 experiments, together with the atmospheric conditions prevailing at the time. The experiments were made in a garden, in a bed-room, in hospital wards, in the open country, &c. A few of the numbers obtained are here given by way of example:—

Fluid collected in minims.	Ammonia in grains per gallon.	Source.
150	1·9712	Erysipelas.
120	0·1791	Garden.
55	6·8807	Drains.
90	2·1000	Bed-room.
	2·9568	Stables.
150	0·0985	Victoria Park.

IMPROVEMENTS IN CHLORIMETRY.

By GEORGE E. DAVIS.

There is a modification of Penot's arsenic method for the estimation of the available chlorine in bleaching-powder now extensively used in commercial laboratories. It has not, however, found its way into many text-books on analysis; the process is as follows:—

Standard Solution of Arsenious Acid.—Weigh off 13·95 grms. of arsenic trioxide, dissolve in caustic soda solution, dilute largely with water, acidify with hydrogen chloride, and dilute exactly to a litre. 10 c.c. of this solution correspond to 0·1 grm. chlorine.

Indicator.—A concentrated solution of indigo sulphate.

Preparation of the Solution of Bleaching-Powder.—After well mixing the sample, weigh off 5 grms. of the powder and rub up with water to a paste, add more water and allow to settle, pour off the nearly clear liquid into a 250 c.c. flask, and repeat the operation until the whole of the powder has been transferred to the flask in the state of solution and fine division, then fill up to the mark with water.

The Analysis.—Take 10 c.c. of the standard solution of arsenious acid, place in a small flask, and add a drop of the indigo sulphate solution. Fill a burette (Gay-Lussac's I prefer) with the bleaching-powder solution which has been well agitated, and add it cautiously to the arsenious acid until the blue colour of the solution is replaced by a brownish yellow. The number of c.c. used must then be divided into 500, which will give the percentage of available chlorine in the powder under examination.

Some operators object to use the process because they say it gives low results, for an excess of bleaching-powder solution is required to oxidise the indigo sulphate, and the more bleaching-powder used the lower the results. This is true partly, but only *one drop* is required to oxidise the indigo, just as one drop in excess of hyposulphite is required to decolourise the iodide of starch in Bunsen's method.

Then, again, others say that it is not advisable to run the bleaching-powder solution into an acid solution, as some chlorine might be liberated and lost. Such objections as these are only puerile, and do not in the least tend to weaken the liking many operators have for the process, those who have tried it and have found it to work most satisfactorily. Now to work upon the theory of the process, all that is wanted is to dissolve the arsenic trioxide in a substance which shall be inactive, as far, at least, as regards the arsenic trioxide, the indigo sulphate, and the bleaching-powder solution. Water will not dissolve the oxide without a great deal of trouble; alkalies dissolve it easily with the production of arsenites, but these alkalies have to be taken up again by adding stronger acids, being only used for easily obtaining the arsenic in a soluble form; but glycerine dissolves arsenic trioxide easily; glycerine is not acted upon by the bleaching-powder solution or by the indigo sulphate, therefore it is specially adapted for the preparation of the standard solution. I now prepare my standard solution thus:—13·95 grms. of arsenic trioxide (which has been powdered in an agate mortar) is heated in a flask with 40 c.c. of pure glycerine until it is all dissolved; the solution is then diluted with distilled water to a litre, when it is ready for use. It is of course of the same strength as that prepared by dissolving in caustic soda and afterwards acidifying with hydrochloric acid, and is used in exactly the same way.

A litre of solution was made by each method and was used side by side for a long series of trials, in order to determine whether the method was reliable or not, with the following results:—

	Bunsen's Method.	Arsenic dissolved in Alkali and Acid.	Arsenic dissolved in Glycerine.
1.	36·72	36·64	36·64
2.	29·82	29·71	29·78
3.	25·86	25·80	25·80
4.	26·58	26·58	26·66
5.	31·33	31·42	31·38
6.	34·41	34·36	34·36
7.	7·16	7·04	7·06
8.	7·18	7·11	7·13
9.	8·33	8·42	8·39

The last three were samples of bleaching liquor, the first two of which were warranted to contain between 7 and 8 per cent of available chlorine and the third 9 per cent.

I find there is a method for testing bleaching-liquor, used in several manufactories which gives an error directly as the specific gravity of the liquor. The analysis should be conducted as described above, but the bleaching-liquor solution should be made as follows:—25 c.c. of the liquor should be diluted to 250 c.c., and then added to the arsenious acid solution, the number of c.c. used multiplied by the specific gravity, and divided into 100 will give the percentage of available chlorine in the liquor. Now some forget to divide by the specific gravity, consequently the percentage is expressed higher than it really is, to the

* Abstract of a Paper read before the Royal Society.

extent of about 1 per cent, for 25 c.c. are in the calculation reckoned as 25 grms., whilst in reality the weight is 28·5 grms. if the liquor possesses a density of 28° Twaddle, which is 1·14 specific gravity.

The turbid solution of bleaching-powder must always be used, and never filtered, or be allowed to settle; for the clear liquid always gives lower results, showing that the insoluble portion carries down chlorine with it, as the following analyses will show:—

	Bunsen's.		Modified Penot's.	
	1.	2.	1.	2.
Turbid ..	38·14	38·09	38·00	38·21
Clear ..	37·41	37·60	37·36	37·72

These determinations were made upon two different weighings of the same powder. No. 1 was brought into solution and estimated first by Bunsen's method, and then by the modified Penot's; the liquor was then allowed to settle, and the clear fluid examined. No. 2 weighing was served in the same manner.

The absence of this method in two at least of our best text-books, and the easy way of preparing the arsenious solution in glycerine, with the advantage of the indicator being in the solution itself, led me to describe it. It is not for the scientific analyst I have done so, but for many manufacturers and consumers of the article who, perhaps, are only acquainted with imperfect or indirect methods: but the solution in glycerine is a novelty; at least I have never seen it described before.

Radcliffe, July 2, 1872.

ON PYRO-PLATING.

By J. BAYNES THOMPSON.

The end of pyro-plating, like that of all other methods of plating, is to affix to a baser metal a sheet of one of the superior metals; but this method is applicable where none of the other methods can be applied with success.

"Close plating," whether with hard or soft solder, cannot be applied with success to any cutting instrument, as a knife or a pair of scissors, &c. Hard soldering would completely destroy a knife-blade or a pair of scissors. The soft solder plating can be applied to a knife or a pair of scissors without destroying the steel, though with difficulty; with the scissors the first attempt to cut would shear off the plating, and with the knife, if it were sharpened so that it would cut, the plating would chip off in using it. Common electro-plating is not applicable to steel or iron, as by that method these metals cannot be got perfectly clean, that is—chemically clean, therefore by that method no adhering coating can be obtained.

In fact, for all manner of plating or soldering, the first requisite is, that the two metals that are to be applied to each other must be chemically clean, or no proper adhesion can be obtained.

This cleanness is obtained in various ways. In soldering by various fluxes; in electro-plating to such metals as that method is applicable; by dipping the article in an acid which will readily dissolve the metal of which it is made,—and not only so, but the salt formed by this solution of the metal in the acid used, must be readily soluble in water, or no clean surface can be obtained. There is still another condition to be considered, that is when the surface of the metal has been made thoroughly clean, it must be protected from contact with the air in its transit from the cleansing-baths to the solution wherein it is to be coated. This condition not being recognised in the first attempts at electro-plating caused many failures and much trouble, till it was discovered that a film of mercury prevented the contact of the air with the cleaned metal. Moreover, mercury has this advantage, that it amalgamates with the metal to be coated, and with the coating, though this amalgamation is not absolutely necessary, yet it facilitates the coating of metals with other metals by electro-deposition, when the two metals will readily amalgamate.

There are cases where amalgamation is not possible; for example, where one of the metals will not amalgamate, as with steel and iron coated with copper, gold, or silver; or when neither will amalgamate, as with steel or iron coated with aluminium or nickel; not that it is impossible to form an amalgam with these metals, for even steel can be amalgamated by the intervention of sodium, but it is not possible for plating purposes, as a diluted solution of a mercuric salt must be used.

Now for all such cases as these where the amalgamation process cannot be used, pyro-plating is especially applicable. The name pyro-plating is given to this process to distinguish it from the Electro-plating process, and because the coating is driven into the surface of the metal on which it is put by means of heat and pneumatic pressure. It is not confined to coating with silver as its name might indicate, but it is at present applied to coating with gold, platinum, silver, nickel, aluminium, copper, brass, or bronze and aluminium bronze.

The *rationale* of the process is very simple; but the various details require much care and attention.

The end to be obtained is simply this. That the metal to be coated shall be "chemically clean" when immersed in the solution in which it is to be coated. There are several ways in which the attainment of this end may be prevented. By inadequate means for cleansing, by the passage through the air of two or three feet after being cleansed, by the metal being positive in the coating solution,—in this case the metal is fouled on contact. This refers to cyanide solutions, to sulphate and chloride solutions, to double sulphates and chlorides, as of nickel and ammonia, and of platinum and potash or soda. All of these may be used in certain cases for pyro-plating, but they are *not* used. There is a special solution used for pyro-plating in all cases, because most of these solutions leave matters in the metal that is being coated, if it be in the slightest degree porous or "roaky," as is the case with steel that has been badly faggoted, and on the article passing through the furnace these matters volatilise, and cause an irruption in the coating. The method used for cleansing steel and iron articles is as follows. They are first boiled in caustic alkali to free them from grease; they are then mechanically cleaned with fine flour emery and brushes in water; they are then brushed with steel wire brushes under a stream of a solution of carbonate of soda; then they are wired and hung in the same solution ready for being made chemically clean. This is done by means of nascent hydrogen in a hot alkaline solution. The water of solution is decomposed on the article by means of a strong current of electricity, the article being made negative. If the solution be kept strong and not carbonised, a film of this solution is sufficient to protect the article from contact with the air in its quick transit from the last purifying process to the solution wherein it is to be coated. The time for it to be transferred can easily be seen by the experienced eye; the article assuming gradually a more silvery appearance. After the proper amount of metal is put on in the coating bath the articles are taken out and washed and dried. The amount of metal put on is ascertained by having a test-surface put in with the articles, and the exact time of putting in and the exact weight of the test noted, and this test is carefully weighed from hour to hour till the amount desired is put on. After being dried, the articles are put into the furnace to have the silver or other metal driven into the surface of the coated metal. The firing furnace, as it is technically called, is of simple construction. The conditions to be observed in its construction are two, namely to obtain a bright red heat in the chamber where the articles are put, and to secure the articles from coming in contact with the fuel or products of combustion. In firing knifes-blades and other cutting instruments care has to be taken that they are not carried higher than

between 450° and 500° F. This is ascertained by trials on a pad of prepared test paper; a blade is taken out from time to time and tried upon the pad and the colour is noted—whether it scorches it straw-colour, yellow, pale brown, deep brown, or black. Alum-water is used for regulating this paper as to the colour for the proper degree of heat. After the proper heat is attained the blade is instantly quenched point downwards in cold water and all that were in the firing chamber with it. For articles that do not require tempering or that are made of metal that will not temper, as iron, copper, good brass, or German silver, the heat may be higher. Even if a steel article should be carried so high as to soften it, it can be re-hardened and tempered with the silver or other metal upon it, without in any way injuring the coating. The theory of this part of the process which is technically called "burning in," is this. The coating metal in all cases is one of the superior metals as compared with the coated metal, and is less porous whether cold or hot.

The article being heated, it naturally expands and becomes more porous, as of course both article and coating do, but their relative porosity remains the same, consequently on expansion there will be an infinite number of small cists into which by atmospheric pressure the coating will be driven on attaining the proper heat. Then on the instantaneous quenching in cold water, the coating is seized and retained by the suddenly contracting under metal. This is seen to be the case on filing or grinding the coating off the under metal; for though the coating may be filed or ground off till both coating and under-metal are filed or ground off together, yet the under-metal remains spotted all over with an infinity of little points of the coating metal.

Whitehall, July 3, 1872.

ANALYSIS OF POTASHES.—METHOD OF M. O. HENRY.

By F. HAMEL.

THE alkalimetric test of commercial potashes gives, as is known, by alkalimetry, the amount of carbonate of potassa contained, when this salt is not mixed with anything but insoluble substances or with other salts of potassa; but it in no way indicates the amount when they are mixed with soda. In order to discover in this case the potassa, and to estimate it, M. O. Henry has proposed the following process, to which he gives the name *Potassimetry*.

This process depends on the property, which potassa possesses, of forming with perchloric acid a salt completely insoluble in alcohol, while the corresponding soda salt is soluble. This last is therefore used as a reagent for precipitating the potassa. It is procured as follows:—

Chlorate of potassa is heated carefully in a platinum dish until the disengagement of oxygen ceases, and dissolved in twenty times its weight of boiling water; filtered through muslin, and allowed to cool, meanwhile stirring to render the crystals small. The perchlorate of potassa is deposited in small white grains, which are washed with a little cold water, and dried in the air-bath. It is afterwards reduced to a fine powder, placed in a large test-tube, in the bottom of which has been put some mercury, and 5 to 6 parts of pure water added. On one side is placed, in a sandstone retort, a mixture of two-thirds fine, clean sand, and one-third of a mixture of fluor-spar and sulphuric acid in the proportion of one to three; an exit tube is fitted to the neck of the retort, the extremity of which tube dips under the mercury in the test-tube. The retort is then heated, hydrofluosilicic acid is disengaged, which passes through the mercury, and reacts on the perchlorate of potassa, forming a gelatinous hydrofluosilicate of potassa, which is insoluble, and freeing the perchloric acid. The reaction being finished, the magma produced is thrown into a linen carrelet, washed with distilled water, and the wash-water saturated with crystallised carbonate of soda. It is then filtered, concentrated on the sand-bath to a syrupy consistency, diluted with about its weight of alcohol of 37°, heated gently, and filtered. By evaporating carefully the alcoholic solution of perchlorate of soda thus obtained it furnishes white, needle-shaped crystals, from which is prepared, as we shall see further on, the solution for titering.

The instrument used by M. Henry for titering the potassa is made thus:—

A glass tube, about 60 c.m. long and 4 m.m. in diameter, surmounted by a glass cap and terminated by a small faucet, affords a sort of burette, divided into 100 equal parts. This apparatus is borne on a foot, which serves as a support for the apparatus, but which is sufficiently high to allow a beaker glass for precipitation to be placed under the faucet. The pipette, throughout its 100°, is filled with a solution of titrated perchlorate of soda, representing, for each degree, one-hundredth of pure carbonate of potassa. This strength is readily obtained; for this purpose the amount of alcohol of 37° contained in the space of the tube, between 0° and 100°, is run from the tube, and its exact weight taken. Then 10 or 100 times the weight of that quantity of alcohol of 37° is taken, in a graduated flask, and to it is added 10 or 100 times 0·884 grm. of dry perchlorate of soda, which correspond to 1 grm. of pure carbonate of potassa.

We will now describe the working of the potassimetric test. Specimens are taken from various parts of the cask of potash to be tested, to the amount of 250 or 300 grms.; these are mixed, and reduced to a powder as quickly as possible. From this powder 50 grms. are taken, which are treated in the cold with 100 grms. of distilled water. The solution is carefully filtered, and the solution placed in a test-glass graduated into 50 equal parts.

1st. By means of a graduated pipette, 10 measures of this solution, representing 5 grms. of the potassa to be tested, are taken, and subjected to the alkalimetric test, and the alkalimetric degree obtained is noted.

2nd. One measure of the above solution, representing 1 grm. of the potash to be tested, is taken; this is saturated with acetic acid, a slight excess being added, the solution evaporated nearly to dryness, and the residue treated in the cold with alcohol of 37°, then filtered without anything being lost; the alkaline sulphates, chlorides, and silicates remain on the filter. To this liquid, representing in acetate the carbonate of potassa, and that of the soda in the potash under examination, is added, drop by drop, the titrated solution of perchlorate of soda, so long as a precipitate is observable, adding it very slowly, as the level of the liquid in the tube approaches the fortieth and fiftieth graduation. This number indicates, for 1 grm. of the potash examined, the hundredths of pure carbonate of potassa.

On considering on one side, by application of the alkalimetric test, the quantity of sulphuric acid which this potassa saturates, it is easy to arrive at the determination of the proportions of carbonates of soda and potassa mixed together. In effect 100 measures of the alkalimeter represent—

	Grms.
Sulphuric acid at 66°	5·423
Anhydrous sulphuric acid	4·429
Which is equivalent to pure anhydrous KO,CO_2	7·600
Which is equivalent to pure anhydrous NaO,CO_2	5·740

On the other side, by means of the potassimeter, the real amount of carbonate of potassa in 100 parts has been determined.

Since this amount should require of actual sulphuric acid the difference between the entire amount of this acid employed in the alkalimetric test and the amount corresponding to the carbonate of potassa determined by the potassimeter, this will give at once the carbonate of soda added, and the double problem will be solved, *i. e.*,

the determination of the real amount of potash present, and the proportion of carbonate of soda added.

Let us take an example to facilitate the understanding of these facts.

100 grms. of commercial potash, taken as stated, giving—

1st. By the alkalimetric test, a number of degrees representing actual anhydrous sulphuric acid, 38·9 grms.

2nd. By the potassimetric test, a number of degrees representing carbonate of potassa, 50 grms.

We have 28·9 anhydrous sulphuric acid for the 50 of pure carbonate of potassa.

The difference, 10 of acid, will represent pure carbonate of soda, 13·3 grms.—*Revue Hebdomadaire de Chimie.*

MILK ANALYSIS BY THE AMMONIA PROCESS.

By J. ALFRED WANKLYN.

The ammonia process, which Chapman, Smith, and myself applied to water analysis in the year 1867, is available for a great variety of purposes. There is a very simple application to the analysis of milk, which I propose to describe on the present occasion.

In our little book on water analysis, we gave the proportion of "albumenoid ammonia" yielded by caseine as 7·6 per cent. As we remarked, we could not guarantee the absolute purity of the caseine employed for that determination. Recent experiments, however, do not greatly modify the result. Apparently, the number was given a little too high, 6·5 being more in accordance with my later experiments. Inasmuch as normal milk contains 4·0 per cent of caseine, 100 parts of normal milk should give 0·26 part of "albumenoid ammonia," and such is the result of recent determinations.

In order to examine milk by the "ammonia process," the following method of procedure may be adopted. The milk is first diluted to a convenient degree; 5 c.c. (or, preferably, 5 grms.) of milk are placed in a 500 c.c. measure, which is filled up with water to the 500 c.c mark; the milk and water being then well mixed up together, there results a diluted milk. This diluted milk is of such a strength that 1 c.c. contains 10 milligrammes of milk. For the analysis, 50 milligrammes of milk—*i.e.*, 5 c.c. of the dilute milk—is a convenient quantity.

A tubulated retort, capable of holding about a litre, is charged with 400 c.c. of ordinary water of fair quality, such as, for instance, the ordinary river water supplied by the London water companies. Next, then, is poured into the retort 50 c.c. of alkaline solution of permanganate of potash, made by dissolving 200 grms. of solid caustic potash and 8 grms. of crystallised permanganate of potash in one litre of water. The retort is then connected with a Liebig's condenser, by means of a small piece of wide india-rubber tube, and heated by means of a good-sized Bunsen lamp, the naked flame of which may be applied directly to the retort. Distillation then proceeds. The distilled water, as it comes over, should be tested for ammonia by the Nessler test, in the manner about to be described, and by the time 200 c.c. have distilled over, will be found to be quite free from ammonia. This point having been arrived at, the 50 milligrammes of milk (5 c.c. of dilute milk) are introduced into the retort, which will then contain 250 c.c. of water, 10 grms. of potash, and 0·4 grm. of permanganate of potash. The distillation is then proceeded with as long as ammonia comes over, the ammonia being estimated by the Nessler test.

The measurement of ammonia by the Nessler test is managed as follows:—

A solution of iodide of potassium, saturated with biniodide of mercury, is first prepared thus:—35 grms. of iodide of potassium, 19·1 grms. of bichloride of mercury—are dissolved in less than a litre of water, heat being employed to assist the solution of the salts. It will be found that a slight excess of biniodide of mercury will remain undissolved—filter or decant so as to separate this small quantity of undissolved red iodide of mercury. (Should, through failure to have used the proper proportion of the salts, there be no excess of undissolved iodide of mercury, a little bichloride must be added, until the red precipitate begins to be permanent). Add, then, either 120 grms. of solid caustic soda, or 160 grms. of solid caustic potash. Dilute the liquid with water to the volume of a litre, and this is the *Nessler reagent*. Before using the *Nessler reagent*, add about 5 c.c. of strong aqueous solution of corrosive sublimate, which will occasion a slight precipitate; decant off this precipitate, and the clear liquid is fit for use. This last addition of corrosive sublimate has for its object the rendering of the Nessler reagent sensitive.

Use of the Nessler Reagent.—Into a cylinder made of colourless glass, and marked so as to be a 50 c.c. measure, put the distillate which you desire to test for ammonia. Add 1½ c.c. of Nessler reagent, which will produce a yellowish-brown colouration. Observe the depth of the colour. On a white piece of paper, side by side with the cylinder containing this coloured liquid just mentioned, place a second 50 c.c. cylinder. Into this second cylinder put pure distilled water, and add to the pure distilled water some standard dilute ammonia liquid—as many measures of the standard ammonia as you judge to be requisite. Add 1½ c.c. of Nessler reagent—a colouration will result—compare the colour with the colour of the liquid in the first cylinder. If the colours are equal, write down the quantity of ammonia you have added, and that will be the quantity contained by the 50 c.c. of distillate. If the colours are not equal, make another trial with a different quantity of standard ammonia, and so on until you get equal colouration.

The strength of the standard ammonia is such that 1 *c.c. contains* 1-100th *milligramme* of ammonia. It is made by dissolving 0·315 grm. of chloride of ammonia in one litre of distilled water, and then mixing that solution with nine times its volume of pure distilled water.

The operation of Nesslerising, as it is called, that is, the operation just described, is not difficult, as the many chemists who are in the habit of practising it have abundantly testified. There are a few little points requiring attention; thus a few minutes must be allowed to elapse before reading off the colour: the liquid must be cool, the distilled water must be very free from ammonia, &c. The distilled water used for Nesslerising is best prepared by the operator himself. A fair river water being taken, is set to distil; at first ammoniacal water will distil over, but after a time water free from ammonia will distil, and this must be tested, and then carefully preserved for use.*

The following are some examples of milk analyses by the ammonia process:—

Milk yielding 12·92 per cent of solids and 8 per cent of cream.

	Quantity of Milk taken.	Quantity of NH_3 obtained.
Exp. I.	100 milligrammes.	0·27 milligramme.
Exp. II.	50 ,,	0·13 ,,
Exp. III.	50 ,,	0·13 ,,

Milk which appeared to have been somewhat skimmed, but not watered. Solids, 11·42 per cent.

	Quantity of Milk taken.	Quantity of NH_3 obtained.
Exp. I.	50 milligrammes.	0·135 milligramme.
Exp. II.	100 ,,	0·255 ,,

Slightly-watered milk. Solids, 10·20 per cent.

	Quantity taken.	Quantity of NH_3 obtained.
Exp. I.	50 milligrammes.	0·095 milligramme.
Exp. II.	50 ,,	0·095 ,,
Exp. III.	100 ,,	0·220 ,,

* For further details, I would refer to the book on Water Analysis, by Chapman and myself.

Highly-watered milk. Solids, 6·18 per cent.

	Quantity taken.	Quantity of NH_3 obtained.
Exp. I.	50 milligrammes.	0·075 milligramme.

Highly-watered milk. Solids, 8·10 per cent.

	Quantity taken.	Quantity of NH_3 obtained.
Exp. I.	50 milligrammes.	0·070 milligramme.

Expressed in a tabular form:—

	Per cent. Solids in Milk.	Per cent. of Ammonia.
I.	12·92	0·27
II.	12·92	0·26
III.	12·92	0·26
I.	11·42	0·27
II.	11·42	0·255
I.	10·20	0·19
II.	10·20	0·19
III.	10·20	0·22
I.	6·18	0·15
I.	8·10	0·14

In order to translate these results into percentages of caseine contained by the different samples of milk, it has to be borne in mind that 6·5 parts of ammonia correspond to 100 parts of caseine. The ammonia, therefore, when multiplied by 100 and divided by 6·5 indicates the caseine. In conclusion, the ease and rapidity of these determinations may be referred to. In half an hour an analysis of milk by the ammonia process may be easily made.—*The Milk Journal.*

ON THE

EVIL EFFECTS OF THE USE OF ARSENIC IN CERTAIN GREEN COLOURS.*

By FRANK W. DRAPER, M.D.

EVERYBODY knows that arsenic is a deadly poison. Its name at once suggests to the popular mind a virulence of action possessed by only a few of the kindred agencies which are placed at the disposal of mankind. Although recognised by the physician as a valuable remedy under certain conditions, its administration is advisedly attended with special caution, its minimum dose being fixed at a very small fraction of a single grain. Murderously-disposed men have found it a quick and subtle means for the accomplishment of their malicious purposes; and discontented mortals, tired of life, have taken it as an efficient instrument for self-destruction. In acknowledgment of its deadly power, wise legislative enactments have prudently regulated and restricted its sale by druggists and others, with a view to protect mankind, as far as may be, from the evil effects of its indiscriminate distribution.

In contrast with this general knowledge of the poisonous properties of arsenic, and with the carefully devised measures which are enforced in order that the least possible harm may result from the employment of such an agent, is its unrestricted use in certain arts, and in the manufacture of certain articles which, by most persons, are deemed harmless. The application of arsenic as an ingredient in certain pigments is very extended. It finds its way thus into our dwellings is spread on the walls of sleeping rooms, is worn in articles of dress, and assumes a great number of forms in which its presence is unsuspected, or, if recognised, is not deemed deleterious. It is the object of this paper to point out some of these forms in which arsenic is introduced to daily use, and to inquire if this liberal exposure is productive of harmful results.

The investigation is not an original one. At various intervals during the whole of the present century, attention has been called to the subject by scientific observers; strong warnings have been given of the danger which was believed to be entailed, and earnest appeals made for some effective legal measures of restriction or of prohibition. So long ago as 1740, the employment of arsenic as a pigment in certain manufactures was forbidden in France, and attempts have been made from time to time since then to regulate trade in this respect. These warnings and enactments have, however, proved but partially effectual; and it is believed that at the present day the subject is one which warrants solicitude in behalf of the public health, and justifies renewed investigation by its continued magnitude.

Arsenic, aside from its utility as a remedial agent, is chiefly employed to form an ingredient of certain green colouring matters. It enters into two of these pigments —the arsenite of copper, which is Scheele's green, and the aceto-arsenite of copper, called also Schweinfürt green, from the town where it is largely manufactured. To both of these names are, moreover, given interchangeably, and they are generally known among workmen as emerald green or "emerald," mineral green, sometimes (although erroneously) as Brunswick green or Vienna green. In France, they are called *vert Anglais*, or English green. Of these colours, the former (Scheele's green) contains more than one-half its weight (55 per cent) of pure arsenious acid, or white arsenic; while the Schweinfürt green is still more abundantly supplied, having, in 100 grains, 58 grains of the poison.

Either of these combinations of arsenious acid and sulphate of copper forms a very beautiful and durable green colour whose brilliancy will bear any light well. Its tint is a lighter and purer green than any other of artificial manufacture, and hence is especially alluring to the eye. The materials of which the pigments are made are comparatively inexpensive, and the manufacture involves very little intricacy or delicacy in its various processes. For these reasons, these arsenical greens have always maintained their popular favour, both with manufacturers and the public in general. Their use has been, and still continues to be, extensive and lucrative, giving employment to large numbers of workmen. So important has their application been considered in the making of wall-paper and of artificial flowers in Paris, that when, at one time, it was agitated whether it were practicable to prohibit the use of arsenic in these arts, certain of the manufacturers protested that such an edict would necessitate the absolute suspension of their works. In 1860, a manufacturer of paper-hangings in England stated that he used 2 tons of arsenic weekly;* and the amount of the colour annually manufactured in England was estimated in 1862 at from 500 to 700 tons.†

It should not be inferred from these statements that all green pigments in ordinary use are arsenical. Not a small proportion of the green colours employed for painting, dyeing, or colour printing are of other and comparatively harmless composition. It is not always easy to distinguish them by their physical appearances, but chemistry affords a ready test which may be easily applied. The suspected green material is to be placed in a solution of ammonia. If arsenite of copper be the colouring agent, the liquid will acquire a blue tint, owing to the disengagement of the oxide of copper from its combination with the arsenic. If a further test be desired, a few drops of the coloured ammoniacal solution poured upon crystals of nitrate of silver will leave on the crystals a deposit of yellow arsenite of silver.

These arsenical green pigments are both deadly poisons, differing in the intensity of their effects only in slight degree from the pure arsenic of which they are in part composed. Taken into the stomach, they give rise to the same train of symptoms and demand the same prompt antidotes. The combination of the arsenious acid with

* From the "Third Annual Report of the State Board of Health of Massachusetts."

* Taylor, "On Poisons," p. 430.

† "Fifth Report of Medical Officer of Privy Council," 1863, p. 129.

copper serves only to dilute the poisonous properties of the former, and offers no farther protection against its action. Suicides have availed themselves of the pigment as a means of self-destruction. In 1849, a girl, aged 12 years, a maker of artificial flowers, became possessed with a distaste of life remarkable at her age. She swallowed a quantity of the arsenical green powder used in her work; symptoms of acute arsenical poisoning promptly supervened, and in spite of remedies, vigorously applied, the girl died in a few hours.

Such are the properties of the green colouring matters containing arsenic. It remains to study some of the forms under which they are presented to the public, with the dangers pertaining to their indiscriminate employment.

I. *Artificial Flowers and other Articles of Dress.*—The manufacture of artificial flowers constitutes an important and extensive industry both in this country and abroad; and into some of its various branches the employment of the arsenical greens has largely entered. Many of the green sprays of artificial grass and leaves which so closely imitate the verdure of nature and bring out in artistic contrast the floral colours with which they are combined, owe their delicate shade and brilliancy to the presence of emerald green.

The process of manufacture is a simple one. Generally, the texture from which the leaves are to be cut is coloured in the piece. The colouring material is made by thoroughly stirring together a mixture containing, in definite proportions, the green pigment, cold water, and starch, gum-arabic, or some similar substance which shall give the colour consistence and adhesiveness. Not unfrequently, in this process, the hand and fore-arm are freely used in the liquid, to expedite the work. Of this mixture, properly prepared, the workman takes a quantity in his fingers, and roughly spreads it over the muslin or fine calico. The fabric is then beaten and kneaded between the hands until it is uniformly coloured; the longer this process is continued the more perfect is the result. The cloth is now fastened to a frame for drying. In all this process of colouring, the hands, fore-arms, and frequently also the face of the operative must become soiled with the green colour. It will be also observed that the colour is but loosely applied, no mordant being used, as in calico-printing, to fix the pigment in the texture of the cloth.

In the various subsequent processes of cutting, stamping, shading, and mounting, to which the material must be subjected before the plain cloth becomes the artificial leaf, the arsenical green which is used to produce such a close resemblance to natural verdure inevitably escapes in greater or less abundance, and mingles with the ordinary dust of the apartments in which the manufacture is carried on. Moreover, some of the special methods which are employed to perfect the work promote the dissemination of the powder: thus, in the operation called "fluffing," which consists in dipping the leaf into warm wax and immediately dusting the dry colour upon it from a dredging-box, the workman is particularly exposed to the effects of the freely-floating particles. All the manipulations, in short, subject the material to varying degrees of violence, by which the arsenical powder is detached. This powder is inhaled by those exposed, and the precaution sometimes employed of placing towels or other masks before the mouth and nostrils cannot furnish absolute protection to the wearers. The moist skin attracts the dust, and the clothes give it lodgment. The soiled hands are not often perfectly cleansed before they are used to convey food to the mouth, and an additional source of risk is thus provided.

The quantity of arsenic which, in the various processes of their manufacture, these artificial leaves are sometimes made to take up would appear almost incredible. Careful chemical analysis has determined this amount repeatedly. Hofmann found, in a single twig of twelve leaves, 10 grains of pure arsenic. A lady might thus carry, in all innocence, to an evening party enough arsenic in her floral adornments to destroy herself and a score of her fellow guests.

The effects which exposure to the arsenic contained in artificial leaves may produce, either in those engaged in their manufacture or in those who use them, have been renewedly made the subject of careful investigation. Intelligent and impartial scientific observers in France, Germany, and England do not hesitate in declaring the pernicious influence of continued exposure to such conditions, and numerous instances are cited to demonstrate not only harmful, but occasionally fatal effects. An investigation was made by M. Vernois, in 1859, concerning the accidents resulting among the flower makers of Paris from the use of arsenical greens, and, as the result of his researches, he points out many symptoms which, he believes, may be directly traced to arsenical infection. Among these are included various eruptions on the skin, presenting sometimes a papular form, sometimes vesicular, sometimes a simple diffused redness (erythematous), and sometimes developing to ulceration and gangrene, the seat of the disease being preferably those parts exposed most directly to the irritant action of the poison, as, for example, the hands and face, the former especially presenting ulcerations if the colour enters cuts or abrasions. Along with these external symptoms are loss of appetite, nausea, colic, continued headache, pallor, and debility.* Dr. Hassall, writing in England at about the same period, in describing one of his visits to a manufactory of artificial flowers in London, states:—

"In the same room were two men, eight women, and two boys, the condition of all being wretched in the extreme. They were all similarly affected. They all had sores; the girls, at the back of the neck, on the sides of the nose, and on the hands; their eyes were also affected, and there was running from the nose. To such an extent was their health affected that they were obliged from time to time to give up their work and return home."†

Dr. Hillier, too, investigated the condition of the London flower-makers in 1861, and found that they "suffered from chronic inflammation of the stomach and bowels, irritation of the eyes, great nervous debility and prostration, with local irritation of the skin of the hands, neck, and scalp when the powder was brought into contact with, and allowed to remain on, those parts." Several workpeople stated that they were constantly ill while working with this powder."‡

But besides these generally acknowledged symptoms of chronic arsenical poisoning, as manifested in these people after working continuously with emerald green, still more serious results are possible, and cases are recorded of fatal effects upon specially susceptible organisms. The following is illustrative:—In 1861, a girl, aged nineteen years, who had been engaged continuously during eighteen months in making artificial flowers with emerald green, died in London with all the characteristic symptoms of chronic poisoning by arsenic. Her sufferings were very greatly intensified towards the close of life. Examination after death discovered the very evident presence of arsenic in the internal organs.‖

These exceptionally fatal cases bear very small proportion, it is true, to the numerous well authenticated instances of less serious results which are notorious among the operatives themselves as arising in their vocation. This is explained partially by the fact that such fatalities might readily be ascribed to other causes, supposing them to occur more frequently, while, on the other hand, it is obvious that persons exposed to such a noxious influence would probably desist from this work long before the symptoms were serious enough to threaten a fatal termination.

But not only do the operatives, who in making the

* *Annales d'Hygiène*, 2nd ser., tome xii., p. 319.
† *Lancet*, 1860, p. 535.
‡ "Fifth Report of Medical Officer of Privy Council," 1862, p. 126.
‖ *Medical Times and Gazette*, Nov. 30, 1861.

artificial flowers use the arsenical greens, suffer in proportion to their susceptibility and exposure, but in many cases also those who wear them, and those who, like shopkeepers and milliners, habitually handle them. A case is reported of a clerk who always had vertigo, headache, nausea, and cough whenever he opened and handled new packages of green artificial foliage.* In another instance which is recorded, a lady's shoulders became the seat of a painful eruption directly after each occasion of wearing a wreath of artificial flowers and leaves at evening receptions; and, in two other reported cases, an erysipelatous eruption on the forehead was traced to a similar cause.† The physicians to some of the large London hospitals have expressed themselves as familiar with "the inflamed eyes and disfiguring eruptions," which, as they assert, result from the use of the arseniferous verdure.

It is obvious that of such cases only the most remarkable and clearly defined would be reported; and we may reasonably infer from these that many less distinctive instances really occur. It is not unreasonable to suppose, for example, that the health of milliners, proverbially delicate as a general thing, may depend for its deterioration to some extent upon this factor, as well as upon overwork, crowded and ill-ventilated rooms, and insufficient exercise. It is bad enough to inspire an ordinarily foul atmosphere, but it can certainly add nothing to atmospheric purity to mingle with the dust of a room any proportion, however small, of oxide of copper or of white arsenic.

Closely related to the foregoing topic, is the use of the arsenical green pigment in the manufacture of other articles of dress; and among these the material called tarlatane, a light fabric resembling muslin, has attracted much attention. The mineral green with which the material is coloured recommends itself because of the brilliancy of its shade and of its permanency by artificial light; and the fabric has therefore at times been quite fashionable. A considerable quantity of it is still sold for dresses, or for the trimmings used by milliners. It is known popularly as an "arsenical" green, so that its character is not altogether unrecognised.

In the manufacture of this material, the colour is fixed only by starch or size, and when tarlatane is torn, a plentiful cloud of light green arsenical dust arises. The slightest agitation also serves to disengage the coloured powder, and to diffuse it through the adjacent air. It is easy to discover how readily the wearer of one of the expansive dresses prescribed by fashion might under certain circumstances surround herself with a cloud of poisonous dust of whose effects on herself and on those about her she would be unhappily ignorant.

The arsenical-green tarlatanes contain nearly half their weight of colouring matter. A sample, procured by the writer in one of the retail stores of Boston, was analysed quantitatively by Prof. William Ripley Nichols at the Massachusetts Institute of Technology, and found to contain 8·21 grains of arsenious acid (white arsenic) to each square foot. A dress of ordinary dimensions would thus hold feebly in its texture between three and four ozs. of pure arsenic.

It would not seem probable that the occasional wearing of such a material would produce symptoms of serious harm to either the wearer or to those around her, the noxious exposure in such cases being limited in time and degree. Yet instances are not wanting to demonstrate its deleterious effects on those engaged in making the fabric into dresses. In one case, reported by Chevallier, five dressmakers were more or less seriously affected after working on the tissue.‡ Two years ago a similar instance of poisoning occurred in France, where arsenical greens are prohibited by law; and the dress was found to contain nearly eight ozs. of arsenic.* On one occasion, where a new ballet was performed at Hamburg, the dancers who represented water nymphs, were dressed in green tarlatane. These dresses "nearly cost the lives" of those who made them, and of those also who wore them. So large was the quantity of arsenic in the fabric that nearly all were more or less poisoned.†

In 1869 a case of poisoning from the cause under consideration occurred in Boston, the details of which were given to the writer by one of the persons affected. Four dressmakers, while engaged upon some party dresses of which the material was arsenical green tarlatane, became simultaneously affected with well-marked symptoms. These symptoms consisted of swelling of the hands and face, a "pimply" eruption on the back of the hands and about the nostrils, running from the nose, and free lachrymation. With these local effects were headache, lassitude, and a feeling of general illness. The attack coming on in the midst of perfect health, and affecting all but one of those who worked upon the arsenical fabric, left little doubt in the minds of the sufferers of the nature of the poison. The symptoms subsided as soon as the exposure ceased.

(To be continued).

* *Dublin Quart. Journ.*, vol. xxxii., p. 234.
† *Ibid., loc. cit.*
‡ *Annales d'Hygiene.* xii., p. 99.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.‡

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 20).

Red Colouring Substances (continued):—*Munjeet; Campechy, Peach, Sappan, Cam, and Bar Woods; Alkanet Root; Safflower; Cochineal, Lac-Dye; Murexide.*

Munjeet.—It is to the researches of Dr. John Stenhouse, one of the most eminent and learned of English chemists, that we are indebted for our knowledge of the true composition of many of the dye-stuffs, and it is to him that we are indebted for the whole of the information we possess in the colouring matters of munjeet, or *Rubia Munjista.*

This peculiar variety of the genus *Rubia* is cultivated exclusively in Asia, and especially in India, where it has been used as a dye-stuff for a long period of time, either alone or mixed with other dyes, to produce a variety of red shades. It is imported into this country from time to time, but has never been extensively used, as the colours produced from it are neither so fast nor so bright as those obtained with *Rubia tinctorum.*

Whilst the colouring principles of madder are purpurine and alizarine, those of munjeet are purpurine and a yellow colouring matter, named by Dr. Stenhouse munjistine. He has assigned to this latter body the formula $C_{16}H_8O_6$. When crystallised from an alcoholic solution, it forms large, beautiful, golden-coloured flakes, which sublimed, give prismatic crystals, of an orange-red colour. It is only slightly soluble in cold water, but freely soluble in hot water. Its best solvent is bisulphuret of carbon, which was employed with success by Dr. Stenhouse in separating the purpurine and munjistine from the other substances existing in munjeet. He states that the munjeet root contains as much colouring matter as the *Rubia tinctorum*, and, according to Mr. Higgins, of Manchester, it yields from 52 to 55 per cent of a garancine; but as it has only half the dyeing power of ordinary garancine, it cannot be employed with advantage for this purpose. The inferiority of munjeet arises from its containing only the comparatively feeble colouring matters, purpurine and munjistine. Munjeet is not much used by calico-printers,

* Chemical News, Sept. 10, 1869.
† *Medical Times and Gazette*, April 11, 1863.
‡ The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

as the munjistine gives a brownish-purple with salts of iron, which prevents it being employed with that mordant. It is used for special shades of Turkey-red, the munjistine giving, with salts of alumina, an orange-yellow colour, which is in some instances employed by the dyers.

I have now the pleasure of calling your attention to an important class of dyeing substances, "the dye-woods."

Campechy or Logwood.—This wood, obtained from a large tree of the leguminous family, called by the botanist *Hematoxylon campechianum*, grows abundantly in the West Indies, Mexico, and other states of South America. The best quality is imported from the Bay of Campechy, in the Gulf of Mexico. Large quantities are also obtained from Jamaica and St. Domingo. The qualities obtained from Honduras, Martinique, and Guadaloupe are inferior.

Campechy was introduced into Europe by the Spaniards, but it was not till the reign of Elizabeth that it came into use in England, and then only for a short period, after which its employment was forbidden under the severest penalties for upwards of a century.

The discovery of its colouring principle, hematine, was made in 1810, by my learned and venerable master, M. Chevreul (who, although now 85 years old, is still actively engaged in scientific pursuits). Shortly afterwards it was studied by Ermann, who gave it the name of hematoxyline. It was obtained by these eminent chemists as yellowish white prismatic crystals, which become discoloured by contact with the oxygen of the air and the small amount of ammonia which the atmosphere contains. It is only slightly soluble in cold water, but much more so in hot. It is very soluble in alcohol, ether, and bisulphuret of carbon. It combines with three equivalents of water, forming a crystalline hydrate, which at 212° F. retains one equivalent.

Hematine in the presence of oxygen, especially under the influence of alkalies, assumes a beautiful purple colour. This colouring matter can be obtained under the form of purple-black crystals, having a metallic lustre, and has received the name of hematëine. Hematine has the formula $C_{16}H_{14}O_6$, which, on conversion into hematëine, becomes $C_{16}H_{12}O_6,H_2O$. The hydrate is $C_{16}H_{14}O_6,3H_2O$, which at 212° F. becomes $C_{16}H_{14}O_6,H_2O$.

The oxidation, and consequent colouration, of hematine under the influence of oxygen and alkalies is so rapid that it may be used as a most delicate test of the presence of carbonate of lime in natural waters; and it is a fact well known to practical dyers that waters containing a large quantity of carbonate of lime are well adapted for the production of good logwood blacks. Hematine gives little or no colouration with salts of protoxide of iron, but hematëine gives a dark purplish blue; the latter also gives dark blue precipitates, with salts of lead and tin. Hematëine is easily reduced to hematine by hydrogen and sulphuretted hydrogen.

In my opinion, the colouring matter in *Hematoxylon campechianum* exists in the state of a glucoside, for when the trees are felled the wood is colourless; but by the time the logs arrive here the outside is of a dark red colour, whilst the inside has only become of a pale yellow colour.

As hematëine is the principle which the dyer requires, the logs are ground into a coarse powder, which is moistened and laid in beds 15 or 20 feet long by 10 or 12 broad, and about 3 feet thick. A slow fermentation ensues, by which the glucoside is decomposed and the hematine liberated. It is converted into hematëine by stirring the mass, thus exposing it to the oxygen of the air, the action being quickened by the ammonia of the atmosphere as well as by that given off by the decomposition of the azotised principles existing in the wood.

This prepared wood is used by the dyer to produce logwood blacks, as I shall describe further on, and also by wood extract manufacturers, who prepare an extract which is much used in calico-printing. To prepare this extract it is necessary that the wood should not be too highly oxidised, and that the solution obtained from it by successive and repeated lixiviation should be slowly concentrated at a comparatively low temperature, that is to say, not exceeding 150° F.; for if a high temperature be employed the hematëine is still further oxidised, and a dark purple resinous principle produced, which spoils the brilliancy of the colour.

This extract is chiefly used in print works, to produce purples in steam styles.* A strong logwood solution is thickened with starch, and printed on a prepared cloth; that is, a cloth that has been passed through a solution of stannate of soda, then through weak vitriol, by which means the binoxide of tin has been fixed as a mordant in the fibre of the cloth; the fabric after washing and drying, is ready for the printer. After being printed, the cloth is either rolled on a perforated cylinder or hung in an iron chamber, and submitted to the action of steam, when the hematëine combines with the oxide of tin, producing a beautiful purple.

If blacks are to be produced, an iron mordant is fixed on the fabric, which is then passed through a logwood solution. It is afterwards washed, and the black fully developed by passing it through a hot dilute solution of bichromate of potash.

Logwood and its extract are much used in Yorkshire for producing cheap blacks on mixed fabrics, which are goods in which the warp is cotton and the weft woollen. The black is produced by dyeing the fabric in a bath composed of logwood, sulphate of soda, and bichromate of potash.

It is often very useful to distinguish logwood blacks from sumach and other fast blacks, and logwood purples from aniline purples. This is easily effected by submitting the piece to the action of weak acids; the logwood colours assume a bright red tint, while the others remain unchanged.

Brazil Wood.—We shall now pass on to a series of woods which are all obtained from the genus *Cæsalpinia*, belonging to the natural order *Leguminosæ*.

Although these woods have long been employed as dyes by the natives of the countries where they grow, it is only since the introduction of Brazil wood by the Spaniards, that their value as dye-stuffs has been known in Europe. The best qualities are all imported from Brazil. The particular wood known as Brazil wood, derived from the *Cæsalpinia brasiliensis*, has become scarce in the market, from its having been all cut in the districts within easy distance of shipping ports.

The wood most in favour at the present day comes from Pernambuco, and is the *Cæsalpinia Crista*. This tree is also found in Jamaica. That obtained from Sierra Nevada is not of such good quality.

Another variety, bearing the name of peach-wood, is chiefly derived from Nicaragua. A third, known as Sappan-wood, comes principally from Siam, the East Indies, and other eastern countries. A rather inferior quality, known as Lima-wood, is imported from Peru.

All these woods appear to contain the same glucoside, and, like the previous ones, are decomposed by peculiar ferments, into a saccharine matter and a colour-giving principle. This is proved by the following experiments. If the decoction obtained by treating the wood from the interior of the sticks be boiled with a solution of double tartrate of potash and copper (the best known test for grape sugar), no precipitate is obtained; while if the glucoside be first decomposed by boiling with a dilute solution of hydrochloric or sulphuric acid, and afterwards treated with the copper salt, an abundant precipitate of suboxide is thrown down. The decoction,

* Calico printers employ the word style or govels when speaking of a class of goods which are denoted by a word characterising the colouring matter used, or the method employed in producing them. Madder goods and garancine styles may be given as examples of the first and steam styles of the second.

which has only a faint yellow colour, gives a most abundant and brilliant precipitate with subacetate of lead. The colour-giving principle was discovered by M. Chevreul, who gave it the name of *braziline*. By oxidation it is converted into *brazilëine*. It also combines with water, to form a hydrate containing two equivalents of water. Professor Bolley gives the formula of braziline as $C_{22}H_{20}O_7$, and that of the hydrate $C_{22}H_{20}O_7 2H_2O$. He has also made the curious observation that a comparison of the formulæ of hematine and braziline shows a difference equal to carbolic acid, as may be seen by the following table:—

Braziline	$C_{22}\ H_{20}\ O_7$
Hematine	$C_{16}\ H_{14}\ O_6$
Difference ..	$C_6\ H_6\ O_1$ Carbolic acid.

What is still more remarkable is, that by the action of nitric acid upon hematine, he obtained oxalic acid, whilst under similar circumstances braziline yields oxalic acid and picric or trinitrophenic acid, which is the product obtained when carbolic acid is acted upon by nitric acid.

A decoction of any of these woods becomes yellow or orange, (according to the quantity of braziline or brazilëine it contains) on the addition of an acid, and by the addition of an alkali, a beautiful crimson red, the shade of which varies according to the proportion of the two principles. It also becomes red with bichromate of potash, and gives a red precipitate with oxymuriate of tin.

These characters are sufficient to distinguish between a solution of these woods and one of logwood.

To prepare a good commercial extract from these woods, they must be finely ground, as they yield their colour to water with difficulty; like logwood, they must be allowed to ferment and oxidise in the air, but not to the same extent. The concentration of the decoctions differs from that of logwood in the fact that they can bear a higher temperature. The more quickly they are evaporated the brighter are the colours which the extract gives. Dr. Dingler has proposed a process which is stated to give very good results. It consists in adding 4lbs. of gelatine, dissolved in water, to every cubic yard of ground wood, and allowing the whole to ferment for several days. The wood so treated yields a stronger and richer extract than that obtained by the ordinary process; no doubt the gelatine helps the decomposition of the glucoside, and the ammonia produced facilitates the oxidation of the braziline. By the addition of a small quantity of chlorate of potash to the hot extract, Mr. Peak greatly increased its brilliancy, and rendered it more valuable to the printer on account of the brighter colour produced on the fabric.

These extracts are principally used to obtain pinks and reds in steam styles. To effect this, acetate of alumina, chloride of tin, oxalic acid, or acetate of copper is added to the extract, and printed on the prepared cloth already described, which is then submitted to the action of steam.

These woods are also used in conjunction with a little quercitron, or bark, in the production of cheap garancine styles. These inferior garancine prints are easily distinguished from the good ones by means of a hot soap-bath, which only slightly affects the good, while the inferior are almost entirely destroyed. The woods also are sometimes used for the adulteration of garancine.

I may state, before leaving this subject, that the decoction of these woods yield very beautiful pink lakes, which are principally used by paper-stainers.

Common red ink is also prepared by adding a little alum and acid to an aqueous solution of these woods.

Red Sandal, Cam, and Bar Woods.—The next class of dye-stuffs which we shall have the pleasure of studying together are derived from several varieties of the genus *Pterocarpus*, which are indigenous to the tropical parts of both the new and the old world. It is principally from the East Indies, Ceylon, Madagascar, and the coast of Malabar, that santal, sandal, or red sanders-wood is imported, whilst cam and bar woods are procured from the West Coast of Africa.

The colour-giving principle of this class of plants is only developed with age, the young branches not containing any, whilst it is found in large quantites in the trunk. Professor Bolley proved that it is the same colour-giving principle which exists in each variety, and he gave it the name of santaline. MM. Wagermann and Haeffely consider that it has the formula $C_{15}H_{14}O_5$. It is a bright red crystalline powder, insoluble in water, but soluble in alcohol, ether, and acetic acid. The latter solvent yields the colouring matter to albumen, which is an important fact, and may one day be rendered practically useful. Santaline is freely soluble in alkalies, giving a violet-red solution, from which acids precipitate the colouring matter.

Red sandal-wood is chiefly used on the Continent, where it is employed to give a bottom* to cloth which is to be afterwards dyed with indigo. By this process a very fine blue is produced, having a purple hue by reflected light.

Cam-wood, and especially bar-wood, is chiefly used in England for producing on cotton yarns brilliant orange-red colours, known as mock Turkey-reds. They are, however, neither so fast nor so bright as the real Turkey-red produced from madder, and are easily distinguished from it by yielding their colour to a hot soap solution, or to alkalies.

(To be continued.)

A NEW METHOD OF OBTAINING POTASSIUM.

By Prof. A. E. DOLBEAR.

PERHAPS it is not possible to discover a process for obtaining the metals potassium and sodium better than the one usually employed with the carbonates of the metals and charcoal, heated in iron retorts, but it is a very desirable thing to obtain them cheaply on account of their use in the manufacture of aluminum. As I have been successful in obtaining potassium by a method new to me, the process may have some interest to chemists, whatever may be its commercial value.

Some white stick caustic potash of commerce was dissolved in water and then treated with sulphuretted hydrogen in the way commonly described for making potassium sulphide, K_2S. The solution was evaporated until it was solid when cool, when the yellowish mass was mixed with more than its bulk of iron filings and chips, and the whole put into an alembic for distillation. The heat of a furnace was applied till the alembic was of a bright red heat, and the products of distillation were received in common coal oil. The product was rather small, as some of the potassium vapour decomposed the heated vessel; nevertheless the potassium showed itself when the oil was poured off, and the residuum turned upon water by its characteristic ignition and flame. The reaction is simple and may be thus represented. $K_2S+Fe=FeS+K_2$.

I have not conveniences for experimenting upon this on a scale large enough to test its comparative value; it needs some special arrangements of protected vessels, as it violently attacks common crucibles, porcelain, and glass. The materials used for thus obtaining it are of the required cheapness, and the iron sulphide product can again be used to furnish sulphuretted hydrogen for another quantity.

It is probable that sodium can be obtained by an analogous process, but I have not attempted it.—*American Chemist.*

* This term is used in dyeing, to denote that a colour is applied to a fabric with a view of giving a peculiar hue to a dye which is applied after it.

NOTICES OF BOOKS.

A Manual of Chemical Physiology, including its Points of Contact with Pathology. By J. L. W. THUDICHUM, M.D. London: Longmans and Co. 1872.

To the student in Chemistry and other Sciences Dr. Thudichum's work offers a ready help to the acquisition of elementary knowledge, upon which can be afterwards placed the superstructure of more detailed studies. The manual is divided into two parts, the first having been written as the introduction to the Author's "Researches intended to Promote an Improved Chemical Identification of Diseases," published in several numbers of the annual "Report of the Medical Officer of the Privy Council," and being a concise epitome of physiological or animal chemistry. The second part of the work is an Analytical Guide for the use of Students who desire to become practically acquainted with the constituents of animal bodies. The manual is well illustrated with drawings of spectra; is clearly arranged, and contains more than the usual amount of information, supplying a want amongst medical students.

A New Star Atlas, for the Library, the School, and the Observatory. By RICHARD A. PROCTOR, B.A. (Camb.), F.R.A.S., Author of "The Sun," "Other Worlds than Ours," "Saturn and its System," &c. London: Longmans, Green, and Co. 1872.

THIS admirable little Atlas is a reduction from Mr. Proctor's large Star Atlas, and is intended as a companion to Webb's "Celestial Objects for Common Telescopes." It fulfils a crying want, for we have had hitherto no work directing the student of the heavens to its chief star groups. But this little work is so well arranged, that it includes besides the chief features of the heavens, groups that are unattempted in much more pretentious works. It will well repay packing in the trunk and studying on some starry night during the country vacation tour.

Lecture Notes for Chemical Students. By EDWARD FRANKLAND, D.C.L., F.R.S., Corresponding Member of the Imperial Institute of France, &c., Professor of Chemistry in the Royal School of Mines. Vol. II. Organic Chemistry. Second Edition. London: Van Voorst. 1872.

STUDENTS of chemistry under the auspices of Dr. Frankland will be glad to learn that a second edition of the "Organic Chemistry" has been published with the additions required by the advancement of synthetical investigation.

Chimie Organique Elementaire. Lecons Professées a la Faculté de Mêdecine. Par EDOUARD GRIMAUX, Professeur agrégé à la Faculté de Mêdecine de Paris. Paris: Baillière. 1872.

WE are indebted to our French neighbours, and to Dr. Atkinson for one of the best text-books of physical science, and doubtless we shall soon have a translation of this admirable little work from the pen and laboratory of Professor Grimaux, for a better ordered or more complete treatise it would be difficult to find. Written for medical students, the work has not that want of experimental data so common in works on medical chemistry. The modes of preparing the principal organic compounds are fully detailed, their composition considered, and their physiological action explained, while to the latter no undue prominence is given. The work is thus as useful, and perhaps more interesting to the general student of chemistry than the average hand-book, dealing with theory or practice apart; while the information as to the toxic effects of the several substances is not only a valuable but a necessary adjunct. We commend the work, and we cannot do so too highly.

CORRESPONDENCE.

PROPOSED ASSOCIATION OF MANUFACTURING CHEMISTS.

To the Editor of the Chemical News.

SIR,—I have read all the correspondence in your journal as to the organisation of an Association of Manufacturing Chemists, and highly approve of it. No doubt there are many departments of our great staple industry where the varying experience might lead to general benefit without interfering with the specialities of different manufacturers; and the communication of ideas would, as in other important manufactures, lead to improvements that would benefit all. I shall be most happy to afford my small aid to such an institution in any way practicable.—I am, &c.,

PETER SPENCE.

Pendleton Alum Works, Manchester,
July 15, 1872.

To the Editor of the Chemical News.

SIR,—The want of an Association of Chemical Manufacturers is one that I have long felt, as there are many questions affecting the trade that can only be properly ventilated by such a society; among others, I would mention the questions of sampling and chemical analysis. I shall be most glad to forward the scheme in any way, and would suggest that there should be a committee formed who would endeavour to put the matter into a working form. I am convinced that all the principal firms would most gladly co-operate.—I am, &c.,

EDWARD PURSER, Jun.

Plough Wharf, Cubitt Town,
July 15, 1872.

MISCELLANEOUS.

Society of Arts.—Technological Examinations.—His Royal Highness Prince Arthur will preside at a conference on this subject, to be held at the rooms of the Society, in the Adelphi, on Saturday, July 20th, at 12 o'clock. Merchants, manufacturers, and others interested in the movement, are invited to attend.

Quality of Metropolitan Gas.—Dr. Letheby, the chief Gas Examiner appointed by the Board of Trade, has recently reported to the Corporation of the City, and to the Metropolitan Board of Works, on the quality of the gas supplied to the Metropolis by the Chartered, the Imperial, and the South Metropolitan Gas Companies, during the last three months; from which it appears that the illuminating power has never been less than that required by the Acts of Parliament. The common gas of the Chartered Company has ranged from an average power of 16·89 standard sperm candles at the Millbank testing-place, to 17·85 candles at the testing-place at Mile End. The Imperial Company's gas has ranged from 15·72 candles at Camden Street, to 16·85 at Oakley Square, Chelsea; and the gas of the South Metropolitan Company has averaged 15·78 candles. The cannel gas of the Chartered Company has had an average illuminating power of 25·74 candles at Millbank Street, and 26·06 candles at Arundel Street in the Haymarket. With respect to purity, Dr. Letheby reports that the gas at each of the testing-places has been constantly free from sulphuretted hydrogen, but that the fluctuation in the amounts of sulphur have been considerable, as from a miminum of 2·2 grains per 100 cubic feet of gas at Mile End, to a maximum of over 40 grains at Beckton, at Cannon Street, at Arundel Street, and at Hill Street, Peckham; the average proportions at the different testing-places having been as follows:—The common gas of the Chartered Company at Beckton 26·98 grains per 100

cubic feet; at Cannon Street 25·77 grains; at Friendly Place, Mile End, 8·71 grains; at Arundel Street, Haymarket, 18·89 grains; and at Millbank Street, Westminster, 26·96 grains; while that of the Imperial Company has been 32·98 grains at Oakley Square, Chelsea; 28·16 grains at Camden Street, Camden Town; and 25·71 grains at Graham Street, Dalston. The average amount of sulphur in the South Metropolitan gas was 36·05 grains per 100 cubic feet. It is a noticeable fact that the quantity of sulphur in the gas of the Chartered Company at Friendly Place has only once contained as much as 20 grains per 100 feet; and that during the last month the gas at Beckton, at Cannon Street, at Friendly Place, and at Arundel Street, has never contained 20 grains per 100 feet; the average for the month having been from 4·63 grains at Friendly Place to 13·64 grains at Beckton. Dr. Letheby regards this as highly satisfactory. The proportion of ammonia in the gas has not at any time or place exceeded the quantity (2·5 grains per 100 cubic feet) prescribed by the referees; the average amount being from nil to 1·28 grains per 100 feet:

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, June 24, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

Examination of the Rocks containing Native Iron which were Discovered in Greenland in 1870 by Dr. Nordenskjöld.—M. Daubrée.—This extensive essay treats on the lithology of the large meteorites found in Greenland and transferred to Europe last year. The percentical composition of the blackish coloured metallic rock of Ovifak is stated by the author to be as follows:—Metallic iron in free state, 40·94; iron combined with oxygen, sulphur, and phosphorus, 30·15; combined carbon, 3·0; free carbon, 1·64; nickel, 2·65; cobalt, 0·91; sulphur in the state of sulphuret, 2·70; arsenic, 0·41; phosphorus, 0·21; silicium, 0·075; nitrogen, 0·004; oxygen, 12·10; constitutional water, 1·95; hygrometric water, 0·91; sulphate of lime, 1·288; chloride of calcium, 0·039; chloride of iron, 0·027; chromium and copper, 1·01. The author describes at length his method of analysis, and devotes several pages to the discussion of the following points:—Comparison of this rock with meteoric stones and with other rocks met with on our globe; conditions of formation of the Ovifak and other carbon-containing meteorites, and their synthetic imitation.

Solution of Carbonate of Lime by Carbonic Acid.—Th. Schlœsing.—This memoir contains a lengthy account of a series of experiments made with the view to elucidate the action of carbonic acid present in arable soil, from which the following conclusions are drawn:—When carbonate of lime, in excess, is placed in an atmosphere containing a constant proportion of carbonic acid, water simultaneously dissolves free carbonic acid, neutral carbonate, and bicarbonate of lime. The carbonic acid is dissolved according to the well-known proportions, and as if the water contained no carbonate of lime; the solution of neutral carbonate takes place as if in pure water free from carbonic acid: as regards the solution of bicarbonate of lime, its proportion depends, for a given temperature, on the tension of the carbonic acid gas contained in the gaseous mixture experimented with.

Industrial Preparation of Aniline Colours.—MM. Girard and De Laire.—Reserved for full translation.

Newly-contrived Galvanic Element, more particularly Arranged for Therapeutical Purposes, and to be Used with Sulphate of Copper.—J. Morin.—The description of an apparatus which is an improved modification of Daniel's galvanic element, yielding a very regular and continuous current.

Some Paraffin Compounds.—P. Champion.—By the prolonged action, aided by heat, of nitrosulphuric acid upon paraffin (the variety prepared from boghead mineral fusing at 53°), the author has obtained parallinic acid, a fluid which does not solidify at −10°; sp. gr. at 15°=1·14; it is insoluble in water, but soluble in ether, alcohol, wood-spirit, and amylic alcohol; its reaction is acid; it burns with a luminous flame; it is soluble in and forms compounds with ammonia, soda, and potassa; formula, $C_{26}H_{26}NO_{10}$. Its composition in 100 parts is—Carbon, 56·53; hydrogen, 9·42; nitrogen, 5·07; oxygen, 28·98. The soda salt of this acid is soluble in water, but the baryta and silver salts are insoluble in that fluid. The ethylic salt of the paraffinic acid is a solid body, soluble in alcohol and ether; formula, $C_{26}H_{25}(C_4H_5)NO_{10}$. The properties of the methylic and amylic salts of this acid agree with the ethylic salt. By causing nitrosulphuric acid to act for ten days upon paraffin, a compound, $C_{22}H_{22}NO_{12}$, is obtained. Paraffin is readily and rapidly acted upon by fuming nitric acid at 110° under pressure. The action of chlorine, bromine, and iodine upon paraffin is briefly alluded to; the two first-named haloids appear to form compounds with paraffin, but, even at 200°, iodine scarcely acts upon paraffin.

Among the large number of memoirs and papers contained in this number, and bearing upon natural history and other sciences, we call attention to the following essay:—

Dr. Liebreich's Experiments made to Prove that Strychnia is the Antidote of Chloral.—M. Oré.

Gazzetta Chimica Italiana, No. 4, 1872.

The following is the only original paper contained in this number:—

On Chloropicrin.—A. Cossa.—The author first describes, at great length, the rather complicated method of preparation of the body alluded to, which boils at 112·8°, distils without decomposition, but detonates when rapidly heated above its boiling-point. Chloropicrin is readily soluble in benzine, sulphide of carbon, ethylic and amylic alcohols, but is not very soluble in ether; chloropicrin dissolves iodine, caoutchouc, resins, cinnamic and benzoic acids. The author gives, further, an account of his researches made for the purpose of converting chloroform directly into chloropicrin, but this did not succeed; we also find a detailed description of the action of chloropicrin upon alcoholic sulphydrate of ammonium, whereby a violent reaction takes place, and there is formed carbonic acid, sulphuretted hydrogen, sulphur, and also an organic compound smelling like garlic.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 12, 1872.

This number contains the following original papers and memoirs:—

Red Colour sometimes observed in White-Lead.—A. Bannow and G. Krämer.—This memoir contains an exhaustive account of a series of experiments made with eight samples of lead obtained from English, Belgian, and German lead-works, each sample weighing about 50 kilos. It should be observed that the red colour sometimes met with in white-lead is considered to be due to the presence of silver in the lead. The authors, abstaining from any *à priori* opinion on this question, have tried to solve it experimentally, and have therefore made accurate analyses of the samples, with the special view to estimate the impurities (foreign metals) in lead, and for the estimation of sulphur in metallic lead. The authors have devised an ingenious method, which consists in the conversion of the lead, while molten, into chloride of lead, the sulphur being converted into chloride of sulphur, which, being decomposed by water, is converted into sulphuric acid. In addition to tabulated forms containing the results of analysis, this lengthy memoir contains the account of another series of experiments, made with different samples of lead converted into white-lead by processes industrially used. It appears that, provided the quantity of silver present in lead is, as is usually the case in soft lead, very small, the reddish tinge occasionally observed in white-lead is due, not to the presence of silver, but to a defective process of manufacture. This extensive memoir is a valuable contribution to the practical knowledge of white-lead manufacture, and also to the metallurgy of lead.

Joint Action of Heat and Pressure upon Paraffin.—T. E. Thorpe and J. Young.—After briefly referring to a memoir on this subject read at a meeting of the Royal Society, the authors state that they have made experiments on the joint effect of pressure and heat upon paraffin on the larger scale. 3½ kilos. of paraffin (fusing at 46°, sp. gr. at 13°=0·906) yielded about 4 litres of fluid hydrocarbons, of which 0·3 litre boiled below 100°, 1·0 litre at from 100° to 200°, and 2·7 litres at from 200° to 300°; there remained a solid residue in the retort, which, on being treated with ether, was found to have as constant melting-point 41·5, and to consist, in 100 parts, of—C, 85·19; H, 15·34. By the action of bromine, this body was found to belong to the $C_nH_{2n}+2$ series. The authors next describe the results of the fractional distillation of these fluid hydrocarbons. After treating the liquids thus obtained with bromine, these substances were found to be—Pentan, boiling-point 35° to 37°; hexan, 67° to 68°, sp. gr. at 18°=0·6631; heptan, 97° to 99°, sp. gr. at 18·5°=0·6913; octan, 122° to 125°, sp. gr. at 15·6°=0·7165; nonan, 147° to 148°, sp. gr. at 13·5°=0·7279. These hydrocarbons are stated to belong to the series—

$$CH_3---CH_2\ldots.(nCH_2)---CH_3.$$

Acrylic Acid Ether and Acrylic Acid.—W. Caspary and B. Tollens.—By withdrawing the bromine (*entbromung*) from bibrompropionic acid in alcoholic solution, by means of zinc and sulphuric acid, the authors have prepared acrylic acid ether, $C_3H_3O_2.C_2H_5$, a colourless fluid which has a corrosive action on the skin and a very penetrating smell. The formation of this body from bibrompropionic acid is elucidated by the following formula:—

$$C_3H_3Br_2O_2.C_2H_5+Zn=C_3H_3OC_2H_5+ZnBr_2.$$

Free acrylic acid at the ordinary temperature is a liquid, but at −15° it becomes a solid crystalline substance. The authors intend to continue their researches.

Conveniently Arranged Gas-Evolving Apparatus.—V. Wartha.—The description, illustrated by woodcuts, of apparatus intended for laboratory use.

An Observation.—W. Markownikoff.—The contents of this ahort notice relate to the rectification of an error made in one of the papers read by the author at a meeting of the Russian Chemical Society, and misreported in its proceedings.

Reduction-Products of Silicic Acid Ether.—A. Ladenburg.—After briefly referring to his former researches on this subject, the author gives an account of silico-heptyl-hydrogen, $Si(C_2H_5)_3H$, a liquid substance boiling at 107°, smelling like benzoline, insoluble in water and in sulphuric acid, soluble in alcohol and ether, sp. gr. at 0°=0·7510, vapour density=118·5. This substance is violently acted upon by bromine, the result being the formation of silico-heptyl-bromide, $SiC_6H_{15}Br$, a fluid which emits dense fumes by exposure to air; it is yellowish coloured, and gradually decomposed by contact with water. Silico-heptyl-hydrogen is strongly acted upon by strong nitric and fuming sulphuric acids. These reactions give rise to the formation of various new compounds.

Nature of the Silicium Compounds met with in Plants.—A. Ladenburg.—Since the brilliant results of the author's researches have proved that there exists a chemical connection between carbon and silicium, the author discusses in this paper the functions of silicium in plants, and supports his views by reporting the results of experiments which seem to show the existence in plants of organic silicium combinations.

On Propargyl - Alcohol.—L. Henry.—Propargyl - alcohol, $C_3H_3-\text{-}-HO$, is formed by the action of caustic potassa upon monobromated allylic alcohol. The propargyl-alcohol is a colourless, mobile, agreeably-smelling fluid; sp. gr. at 21°=0·9628; boils at from 110° to 115°; vapour density (calculated), 1·93. This alcohol burns in the air with a highly luminous, but sooty flame; its constitutional formula is $CH-\text{-}-C-\text{-}-CH_2(HO)$.

On Sappanin.—J. Schreder.—This substance has been discovered by the author in the commercial extract of sapan wood (*Cæsalpinia sappan*) by treating it with caustic soda. Sappanin is a solid, crystalline, white-coloured body, soluble in alcohol, ether, and boiling-water, and insoluble in chloroform, sulphide of carbon, and benzol. The aqueous solution imparts to chloride of iron a cherry-red colour, while with alkaline hypochlorites a grass-green colour is obtained. Sappanin reduces nitrate of silver, and also the Fehling's copper solution. Air-dry sappanin loses, at 100°, 14·17 per cent of water; the empirical formula of this neutral substance is $C_{12}H_{10}O_4+2H_2O$.

Observations on Landolt's Method of Determination of the Molecular Weight of Bodies from the Volume of Vapour, and Proposed Modification of Grabowski's Apparatus for the Estimation of the Vapour Density.—L. Pfaundler.—Notwithstanding the scientific value of this memoir, its contents are not well suited for abstraction.

Origin of Urea in the Animal Body.—O. Schultzen.—This memoir contains the detailed account of some researches and experiments made with living animals for the purpose of elucidating the origin of urea in the animal body. The urine of dogs fed with methyl-glycocol or with sarkosine was found to contain compound ureas, corresponding in quantity with the doses administered of the above-named substances.

Bulletin de la Société Chimique de Paris, Vol. xvii., No. 9, May 1, 1872.

From the *procès-verbaux* of the last meeting of this society, published in this number, we abstract the following particulars:—

Platinic Derivatives of the Terchloride of Phosphorus.—Dr. Schützenberger and M. Fontaine.—The compound $P(C_2H_5O)_3PtCl$ is decomposed by heat, yielding hydrochloric acid, ethylen, chlorated ethylen, and hydride of methyl; the residue contains phosphoric acid and a metallic-looking substance, which appears to contain PCPt. When the above-named compound is dissolved in ammonia, it yields, by evaporation in vacuum, a deliquescent crystalline mass—

$$N_2\left\{\begin{matrix}P(C_2H_5O)_3Pt\\H_4,2HCl\end{matrix}\right.$$

The compound $P_2(C_2H_5O)_6PtCl_2$ also yields—

$$P_2(C_2H_5O)_6Pt\left.\begin{matrix}\\H_4\end{matrix}\right\}N_2.HCl.$$

Tetrachloride of Naphthaline.—M. Grimaux.—The compound alluded to, $C_{10}H_8Cl_4$, yields, on being heated up to 200° along with water, a body which is soluble in boiling water, crystallisable, fusible at 142°; formula, $C_{10}H_{10}Cl_2O_2$.

The following original papers and memoirs are contained in this number:—

Borate of Lime from Peru (District of Tarapaca).—Dr. Thiercelin.—This memoir treats on the locality where this mineral is found, its origin, and its composition. It appears that the mineral occurs in and near an ancient river bed, while the boracic acid is evidently due to volcanic action. Assuming the mineral to be pure, its composition would be—BoO_3, 41·18; CaO, 16·47; HO, 42·35; but the real composition of the native mineral as found varies greatly, containing as impurities—Insoluble siliceous matter, oxide of iron and alumina, NaCl, SO_3, and NaO. The mineral is evidently a biborate; its formula is $2BoO_3CaO,8HO$. The quantity of BoO found by the author varied from 16·42 to 25·40 per cent. Dilute hydrochloric acid only dissolves the borate, and this property is applied for the purpose of analysis by the author, who treats the finely-pulverised mineral with very dilute HCl (1 to 50 of water).

On Camphic Acid.—Dr. Berthelot.—The author sets forth in this memoir his reasons for not accepting Dr. Kachler's opinion that camphic acid does not exist. It appears that this acid—resulting, according to this author, from the action of alcoholic potassa upon ordinary camphor—has given rise to much controversy and diversity of opinion.

Combinations of Dulcite with Hydracids and Derivatives therefrom.—G. Bouchardat.—This lengthy essay is divided into the following sections:—Combinations formed of dulcite and hydracids without elimination of water; chlorhydrate of dulcite; bromhydrate and iodhydrate of dulcite; combinations of dulcite and hydracids with elimination of water (ethers of dulcite); monochlorhydric dulcitan; dibromhydric dulcite: bromhydric dulcitan; tetrabromhydric dulcitan. This essay is elucidated with a large number of complex formulæ.

Combination of Binoxide of Chromium and Potassic Dichromate; Kalichromic Dichromate.—D. Tommasi.—This paper contains more *in extenso* what has already been noticed (see Chemical News, vol. xxv., p. 214). The formula of the salt alluded to is $[(CrO_2)_3(CrO_3)_2K_2O]H_2O$, or $[(Cr_2O_3(CrO_3)_2)(CrO_3)K_2O]HO_2$.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, May 9, 1872.

The Soumah Iron Mines in Algeria.—C. Mène.—This interesting memoir, elucidated by a series of tables exhibiting the results of analysis of iron ores from these mines, proves that Algeria may become an important iron-producing country; the ores herein described are all of good quality, yielding from 47 to 65 per cent of metallic iron, and all containing manganese, while the insoluble matter is very small in quantity. It appears that the ore is readily accessible, and railways connect the mines with the seaboard.

Foucault's Pendulum for Demonstrating the Rotation of the Earth.—M. Deleuil.—The description, illustrated by a woodcut, of a neatly-made physical instrument for the purpose of elucidating in a lecture-room the phenomenon of the earth's rotation, first exhibited in 1855 in the Panthéon (now Eglise St. Geneviève) by the late Foucault.

Les Mondes, July 11, 1872.

Association Française pour l'Avancement des Sciences.—The first meeting of this association will be held on September 5th in the city of Bordeaux.

Conversion of Electricity into Motion.—Dr. Borlinetto.—The description of an experiment, which can be made with a Holtz's electric machine, whereby the electricity is caused to turn the disc of an electric machine after two large-sized Leyden jars have been introduced into the circuit of the electricity.

Limits of Human Knowledge and Science.—P. A. Cap.

Petites Annales de Chimie.—E. J. Maumené.—The fifth instalment of a monograph treating on the theory of chemistry, illustrated by a series of algebraical and chemical formulæ.

NOTES AND QUERIES.

Laboratory Manipulation.—On page 527 of the *Journal of the Chemical Society* for June, a paper appears, amongst the foreign abstracts, upon two points in manipulation. First, an original method of drying wet bottles is described; and secondly, an ingenious device is named for altering the gauge of glass tubing. It is not my purpose to claim precedence of discovery in reference to either of these communications, though the methods have been employed by me from boyhood upwards; but having contrived a number of expedients for aiding laboratory work, of a similar kind, I do not see what harm it can do me to claim credit for them. As a sample I give a method of emptying large bottles of water in half the usual time. Invert the bottle, and give the contents a rotary motion; the water will then issue in the form of a tube of water, the air entering up the centre without impeding the passage of the water. If this is "abstracted" next month I may feel encouraged to give other processes.—Bottlewasher.

TO CORRESPONDENTS.

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Black Ash.—Your communication was unaccompanied with your name and address.

Amateur Chemist.—Consult Watts's or Ure's "Dictionary of Chemistry."

Student.—See reply to "Undergraduate," in our Notes and Queries column, No. 651, vol. xxv., p. 239.

THE CHEMICAL NEWS.

Vol. XXV. No. 661.

ON THE

PHYSICAL NATURE OF THE COAGULATION OF THE BLOOD.*

By ALFRED HUTCHISON SMEE, F.C.S.

After passing in review the principal opinions hitherto entertained on the real nature of the coagulation of the blood, the author states that he is led to refer the solidification of fibrin in the process of coagulation to the same class of phenomena as the pectisation of colloid liquids, as already hinted by the late Professor Graham and others. He points out, at considerable length, the chief circumstances which influence the change in colloidal fluids, and proceeds to compare the properties of colloid silica with an organic body of the nature of fibrin.

ON AN IMPROVED MODE OF ESTIMATING MANGANESE.

By HUGO TAMM.

The title of this note scarcely reads like fact. Whoever would have thought that room for improvement was left in the estimation of manganese, a metal upon which so much has been written, and for the estimation of which so many ingenious and simple processes have been devised? Yet I hope to have no difficulty in showing that the process which I am going to describe is, on account of its simplicity and accuracy, the true mode of estimating manganese; and I have no doubt that it will be universally adopted for that purpose as soon as it is widely known among analytical chemists.

After manganese has been separated from the substances which usually accompany it, this metal exists in the liquor as chloride of manganese mixed with a strong proportion of ammoniacal salts; and chemists were in the habit of separating manganese from this liquor by means of sulphide of ammonium. The sulphide of manganese obtained, after being washed, dried, and calcined, was re-dissolved in acids, and the solution thus obtained precipitated by carbonate of soda. The precipitated carbonate of manganese, after long boiling, was filtered and washed, dried and calcined, and manganese estimated as the oxide, Mn_3O_4.

This process I need not say was both long and tedious, and attended with real practical difficulties. It was, for instance, difficult to wash thoroughly the carbonate of manganese and free it from carbonate of soda, and generally a complete washing of this precipitate was accompanied by a loss of carbonate of manganese, which, in spite of care and experience in handling it, would pass through the filters.

By the process which I now propose, volatile reagents alone are used, and this, of course, is a most important point; the precipitation is effected in a neutral or slightly acidulated liquor, another important fact; and manganese is precipitated from the liquor in which it exists, after its separation from the substances with which it was originally mixed, in such a condition that the estimation can take place at once, thus saving a deal of time, trouble, and risks.

Consequently we may assume, *a priori*, that this process is very perfect in every respect, and experience will fully confirm this assertion.

* Abstract of a Paper read before the Royal Society.

Estimation of Manganese.

After manganese has been separated from the substances which may accompany it, it is always possible, by means of hydrochloric acid and ammonia, to transform it into a mixture of chloride of manganese and chloride of ammonium; and by a judicious use of these two reagents, and of the test-paper, it is very easy to obtain a neutral or slightly acidulated liquor. In the course of analysis or assaying, this is the condition in which manganese is generally obtained, and it is upon this liquor that the chemist must eventually operate to recover manganese. From the neutral or slightly acidulated mixture of chlorides of manganese and ammonium, manganese can be *thoroughly* precipitated, in the state of *carbonate of manganese*, by means of a slight excess of *carbonate of ammonia*.

In these conditions manganese is not precipitated, as might logically be inferred, as a double carbonate of manganese and ammonia, but as the ordinary protocarbonate of manganese or manganous carbonate, and the precipitation thus effected is so perfect, that in the filtrate it is quite impossible to discover a trace of manganese by means of sulphide of ammonium. Indeed, the precipitation of manganese by carbonate of ammonia, effected in the conditions prescribed, is safer than by means of sulphide of ammonium. I do not mean, of course, the colourless recently-prepared sulphide of ammonium, or the one obtained by saturating the liquor with sulphuretted hydrogen and neutralising by ammonia, for this is a trustworthy reagent, but the yellow sulphide long kept in bottles and which one might be tempted to use.

I have ascertained beyond doubt that in this sulphide, and especially in presence of an excess of chloride of ammonium, both sulphides of manganese and zinc are soluble to an unexpected degree. This solubility may be due to the excess of sulphur usually present in the long-prepared sulphide of ammonium; but I suspect also the presence of an ammoniacal salt of the thionic series. I have not investigated further this reaction, and I must be satisfied for the present, with pointing out the little known but important fact mentioned.

The reaction upon which is based the estimation of manganese is rather startling and unexpected, but the estimation of manganese by this process is quite perfect, and cannot possibly be improved, at least so far as accuracy is concerned. The precipitated carbonate of manganese is allowed to settle in a warm place (boiling not being required) and the whole is filtered. The carbonate of manganese thus obtained is a little denser than the one precipitated by carbonate of soda, and it can be washed with facility with hot water, and if a double filter is used, no trace of the precipitate passes through the filters. After drying, the precipitate is calcined, and manganese is estimated as usual in the state of the oxide Mn_3O_4.

Such is in all its simplicity the improved mode of estimating manganese which I recommend to the attention of analysts. I will now discuss its merits, and expose some of its applications to separation and to analysis.

Separation of Manganese from Lime, Zinc, Nickel, and Cobalt.

After separating manganese from certain groups of substances easy of separation, manganese may still be mixed with lime, zinc, nickel, and cobalt; and the separation of these substances is rather troublesome, but some of them are simplified by the use of the carbonate of ammonia process.

When manganese is precipitated by carbonate of ammonia from the slightly acidulated mixture of chlorides of manganese and ammonium, if lime is present, this earth is precipitated with manganese, and consequently this process is worthless for the separation of those two substances.

When cobalt is present, part of this metal is precipitated in the state of carbonate along with the carbonate of

manganese, to which it imparts a nice pink colour, and part of it remains in solution. Consequently the separation of manganese from cobalt cannot be effected by means of the carbonate of ammonia process. But when zinc or nickel, or both metals, are present, the separation of these two metals is effected with great perfection, manganese being precipitated as carbonate, and both zinc and nickel remaining in solution. This reaction is rather important, for it is not unfrequently the case that manganese, nickel, and zinc exist in the same liquor, and their usual modes of separation are rather complicated, and this process simplifies them; but from what I have said it must be inferred that, although this process is quite perfect as a mode of estimating manganese, it is not capable of being applied to any extent to the separation of manganese from other substances.

Application of the Carbonate of Ammonia Process to the Estimation of Manganese in Manganese Ores.

On the whole, the chief use of a mode of estimating manganese is the determination of the quantity of this substance in manganese ores. If the ore is contaminated with carbonate of lime, it is first treated with very weak cold nitric acid, which dissolves this substance without attacking sensibly the oxide of manganese, and after a few washings it is treated as an ore containing no carbonate of lime, as follows:—From 20 to 50 grs. of the ore are dissolved in hydrochloric acid, and the mixture is heated until the chlorine evolved is thoroughly disengaged. The solution thus obtained is diluted with water, and filtered in order to collect the insoluble residue; and after being carefully neutralised by ammonia, with the usual precautions, it is precipitated by means of succinate of ammonia. Both iron and alumina are precipitated. The mixture is filtered, and to the clear liquor a slight excess of carbonate of ammonia is added. Manganese is thus precipitated completely in the state of carbonate of manganese. This precipitate is allowed to settle in a warm place; it is then collected on a filter, washed, dried, and calcined, and manganese is estimated as the oxide, Mn_3O_4.

Estimation of Manganese in Native Carbonate of Manganese.

Native carbonate of manganese generally contains carbonates of iron and lime. From 20 to 50 grs. of this mineral are dissolved in hydrochloric acid, and when the solution is complete, a little chlorate of potash is added in order to oxidise iron. It is worthy of remark that, whenever iron and manganese exist in a liquor in the state of protoxide, previous to their separation iron ought to be oxidised by means of chlorate of potash. The use of nitric acid, which is often recommended for this purpose, ought to be carefully avoided for the reason that, while the chlorine from chlorate of potash can be driven off quite easily, leaving the whole of the manganese in the state of protoxide, the chlorine evolved by aqua regia remains in the liquor so long as nitric acid is present there, and the consequence is that part of the manganese exists in the state of sesquioxide, which is precipitated with iron.

After the separation of iron by succinate of ammonia, manganese is separated from lime by sulphide of ammonium, and the sulphide of manganese obtained, being re-dissolved in hydrochloric acid, is precipitated by carbonate of ammonia, as has been previously described. But if no lime is present, manganese is precipitated by carbonate of ammonia, immediately after the separation of iron.

It may not be out of place to remark here that in every instance the separation of iron from manganese ought to be effected by means of succinate of ammonia, and that the separation by ammonia which is recommended by some authors ought to be entirely rejected as defective, owing to the rapidity with which ammoniacal protoxide of manganese absorbs oxygen from the air, and is precipitated as sesquioxide. On the contrary, the complete separation of iron from manganese can always be effected with precision by succinate of ammonia, providing the whole of the manganese exists as protoxide, and this condition can always be obtained with absolute certainty if, previously to the addition of succinate of ammonia, the neutral liquor containing iron and manganese is boiled for a little while.

Estimation of Manganese in Native Carbonate of Iron and in Spiegeleisen.

Native carbonate of iron often contains a small proportion of manganese, and spiegeleisen contains from 8 to 12 per cent of manganese. 100 grs. of the mineral are dissolved in hydrochloric acid, and the solution is oxidised by chlorate of potash. 100 grs. of spiegeleisen are dissolved in hydrochloric, with addition of chlorate of potash, or in aqua regia, but in this case the solution must be evaporated to dryness before operating upon, in order to remove every trace of nitric acid. In both instances iron is separated from manganese by succinate of ammonia, and in the filtrate manganese is precipitated by carbonate of ammonia. If lime is present, manganese must of course be separated from this earth by the usual methods before it can be estimated.

These are the chief instances in which the estimation of manganese is useful.

I will not end this note without remarking that the general method of precipitation from neutral or slightly acidulated ammoniacal liquors is capable of being applied to various analytical uses, and in general with great practical advantages.

INFLUENCE OF CHANGES IN BAROMETRIC PRESSURE ON ANIMAL LIFE.

THIS subject has recently been studied by M. Bert, and he communicates to the Paris Academy, in a series of notes, an account of his researches, of which the following is an outline:—

The experiments were made in the physiological laboratory of the Sorbonne. M. Bert first of all communicates certain facts relative to the death of animals subjected to pressures inferior to mean atmospheric pressure, and the state of the air in which they died.

When the pressure to which a warm-blooded vertebrate is subjected is *suddenly* reduced to 15 or 18 centimetres of mercury, the animal is seized with convulsions, and soon dies; and this is the case, whether the receiver is quite closed, or a current of air is allowed to pass through it. But if the pressure is *gradually* reduced, it is possible to keep the animal alive at very low pressures, provided the air about it is being constantly renewed. If the receiver is then closed, the animal dies of asphyxia.

In each case, the capacity of the receiver was inversely proportional to the pressure experimented with. The pressure was gradually lowered to the desired point (as the animal appeared able to bear it), the air being constantly renewed. Then the receiver was closed.

In this way, it was found that birds could not be kept living under 18 centimetres; mammals could bear 12 centimetres; for cold-blooded animals the pressure might be lowered still further.

For the same pressure, the animals which left most oxygen and produced least carbonic acid were kestrels, owls, and grown cats; next followed sparrows, frogs, and kittens; lastly, guinea-pigs.

The quantity of oxygen left in the air after death was greater in proportion as the pressure was less. The opposite was the case with the CO_2.

The numbers for one example may here be given, showing the differences in the composition of the air after death:—

Sparrows.—Pressure of 76·4 c. : CO_2 15·4 p.c.; O 3·6

55·0 c. : CO_2 14·7 ; O 3·6	26·0 c. : CO_2 7·8 ; O 11·2
47·0 c. : CO_2 14·2 ; O 5·2	19·7 c. : CO_2 7·1 ; O 12·8
37 0 c. : CO_2 11·5 ; O 7·4	18·0 c. : CO_2 2·8 ; O 18·0
30 0 c. : CO_2 10·1 ; O 8·7	

Now, in the above cases, the animal's death does not arise from mere diminution of pressure, interfering directly, as a physical agent, with the respiratory movements, or those of circulation ; for a sparrow, *e.g.*, may be kept alive at 12 centimetres pressure if oxygen be allowed to enter, whereas it would die at 18 centimetres pressure if the receiver were kept closed. The death is due to the fact that the pressure of the oxygen in the enclosed space is not sufficient to preserve in the blood the quantity of oxygen necessary to the vital functions.

In a second series of experiments, the confined air was raised above the normal pressure. The animals were sparrows, rats, and frogs. It took about fifteen minutes to produce a pressure of seven atmospheres. However quickly the required pressure was reached, the animal did not seem much affected ; the breathing became gradually slower till symptoms of asphyxia commenced, and the animal succumbed without convulsions, having a temperature of 22° to 27°, or a little above that of the surrounding air. It is clear that the animal had at its disposal quantities of air, and therefore of oxygen, proportional to the pressure employed ; yet, whatever the pressure, death ensued always in very nearly the same time (about three hours for sparrows). And though the pressure was increased by injecting fresh air, the animal was not relieved ; it was relieved, on the other hand, when the air was allowed to escape.

After death, the blood in the arteries and in the veins was, in most cases, very red, and bubbles of gas were found in the right cavity of the heart.

As to the composition of the air in which the animals died, here are the results for sparrows :—

	Carbonic acid.	Oxygen.
Normal pressure	16·0	3·5
1½ atmospheres	15·2	2·6
2 ,, ...	13·7	5·0
2½ ,, ...	11·3	8·5
3¾ ,, ...	7·2	11·1
5 ,, ...	5·6	13·8
7 ,, ...	4·0	15·9
9 ,, ...	3·0	17·2

Generally, the greater the pressure, the less did the animal alter the air at its disposal.

It further appears that, for 2 atmospheres and upwards, the value of the pressure of the carbonic acid is always nearly the same. Thus, 13·7 per cent of carbonic acid at 2 atmospheres represents, at normal pressure, $2 \times 13{\cdot}7 = 27{\cdot}4$; at 2½ atmospheres, 11·3 per cent represents $2{\cdot}5 \times 11{\cdot}3 = 28{\cdot}25$; in the same way, $3{\cdot}75 \times 7{\cdot}2 = 27$; $5 \times 5\,6 = 25$; $7 \times 4 = 28$; $9 \times 3 = 27$.

Death takes place when the carbonic acid contained in the venous blood is unable to escape across the lungs, owing to the pressure of carbonic acid in the atmosphere. And we are led to the conclusion : That a sparrow necessarily dies when there is in its venous blood such a quantity of carbonic acid as equilibrates the pressure of 26 or 28 per cent carbonic acid in the external air. For mammifers, the number is slightly higher ; for reptiles, it falls to 15 or 16. This explains how the birds died all in the same time, whatever the pressure, and how injected air did not relieve them.

The numbers arrived at by experiment led to the further principle that, as regards normal and lower pressures, a sparrow necessarily dies when the quantity of oxygen contained in its blood equilibrates a pressure of about 3·5 of oxygen contained in the external air.

It appears that the proportion of gases in the blood may occasion the death of an animal in three ways—(1) through insufficiency of oxygen (the pressure of the air being 1 atmosphere or under) ; (2) excess of carbonic acid (pressure of 2 atmospheres and upwards) ; (3) both of these combined (pressures intermediate between 1 and 2 atmospheres).

M. Bert next endeavoured to find whether the law relative to the proportion of carbonic acid held good under two atmospheres, by eliminating the cause of death, which consisted in deficiency of oxygen. He used atmospheres which were richer in oxygen than common air. Down to 25 centimetres pressure the law was verified ; *i.e.*, the number expressing the quantity of carbonic acid, multiplied by the number expressing the pressure gave 25, or nearly so. Below 25 centimetres there was divergence.

The explanation given is, that at these low pressures the proportion of oxygen, considered in relation to the normal pressure, is a very small one, and that even in these superoxygenated atmospheres the animal dies of want of oxygen.

On the above principles, it ought to be possible to keep a sparrow alive in an atmosphere of pure oxygen with a pressure little over 2·66 c.

Animals were next confined in superoxygenated air, the pressure of which was over 2½ atmospheres. Here the law above indicated was departed from. But an unforeseen result was met with. When the pressure was raised to 4 or 5 atmospheres, the animal gave signs of suffering and fell into convulsions, which were repeated up to the time of its death (in less than half an hour). These violent effects could not be due simply to pressure, for in common air the animals bore a pressure of 8 or 9 atmospheres without inconvenience. They are due to the larger proportion of oxygen, which, entering the blood, acted poisonously. To produce the same results by simply using air, it would be necessary to exceed 14 atmospheres. Oxygen, therefore, when its proportion in the blood is notably increased, acts as a poison.

At a later period, M. Bert was able to apply a pressure of 20 atmospheres. With common air, the convulsions due to poisoning by oxygen appeared at 15 atmospheres.

Still M. Bert thinks (and he gives proof of it) the injurious action of oxygen must not be supposed only to commence there. It begins to act thus at 6 atmospheres, or (as more refined experiment may yet show) at even lower pressures.

The benefit derived from use of compressed air-baths, on the one hand, and many of the accidents that happen to workers in mines, in diving-bells, &c., on the other, appear to be due, in great part, to the introduction into the system of a quantity of oxygen greater than in the normal state ; and it is with oxygen as with other poisons, small doses of which may be salutary.

If aëronauts, who are stopped in their upward course, not by failure in the balloon, but by the impossibility of living, wished to soar higher, they might accomplish this if they took with them a supply of oxygen to which they could have recourse when the air became too rare. The mechanical arrangements for breathing this conveniently can be easily conceived.

On the other hand, the industries which subject workmen to pressures over 5 or 6 atmospheres entail suffering and death ; which evils might be remedied if there were substituted for the air a mixture of air and nitrogen, calculated so that the pressure of the oxygen should not exceed a certain low limit. A. B. M.

ON THE

EVIL EFFECTS OF THE USE OF ARSENIC IN CERTAIN GREEN COLOURS.*

By FRANK W. DRAPER, M.D.

(Continued from p. 31).

II. *Confectionery, Pastry Ornaments, and Toys.*—It would seem hardly possible that any person, save the

* From the "Third Annual Report of the State Board of Health of Massachusetts."

most reckless or the most malicious, would designedly introduce into articles of food agents of such poisonous potency as the green colours containing arsenic. Ignorance of the properties of Schweinfürt green must have been the only extenuation for the great majority of those confectioners who have ever made use of that substance to impart to their wares a luring but most treacherous colour. Doubtless all the colouring materials which are used so abundantly to give to candy its variegated hues should justly be subjected to the closest scrutiny, and many of them should be unconditionally condemned in view of the baneful effects which they necessarily produce, especially in children. It needs no argument to demonstrate the probable results of the swallowing of even the smallest portion of a colouring material which contains more than one-half its weight of pure arsenic; and a single word of warning ought to suffice to banish such sugar-coated poison from candy-shop windows.

It is a matter for congratulation that, as the result of stringent regulations in other countries, together with a more general enlightenment of the public in such matters, accidents from the use of the metallic pigments in confectionery are now comparatively rare. Repeated and fearful experiences in the past, of which the victims were chiefly children, have borne their fruit. It would probably be a difficult task at the present day to find the arsenical greens designedly incorporated as a colour into any candy intended for eating. It would be better for the community if experience had taught similar abstinence concerning the green pigments in other relations.

Accidents do, however, occasionally occur from the ornaments with which confectioners adorn their pastry, and which are not meant to be eaten. These are not unfrequently coloured in the most reckless manner with emerald green. Misadventures from this source generally affect children who, attracted by the colour and the candy-like aspect of the ornaments, eat them inadvertently. A number of cases of this sort are reported. In one such instance, two children ate a portion of a cake ornament which was coloured green, and narrowly escaped death. Ten grains of the coloured pastry contained nearly 2½ grains of arsenic.* Dr. Fergus reports a similar experience, in which three children were poisoned, exhibiting all the typical symptoms of the effects of arsenic.† In 1857, in Edinburgh, eighteen persons were made very seriously ill, and one child died, after eating a pastry ornament which owed its green colour to arsenite of copper.‡

The ingenuity of caterers has sometimes shown itself in the presentation of the triumphs of their art in a unique manner. M. Chevallier relates, that at a grand dinner-party in Paris, attention was directed to a boar's head which had been curiously decorated for the occasion. The ornament consisted of masses of fat, coloured alternately red and green, so arranged as to give quite an artistic effect. One of the guests, well acquainted with chemistry, was struck with the rich green colour, and reserved a portion for private analysis. He found the colouring matter to be pure Scheele's green, forming about 2 per cent of the weight of the fat. It appeared, on inquiry, that the butcher's boy had procured the colour from an adjacent shop, in spite of the regulation prohibiting its sale.‖

The toys of children are a medium by which these poisonous pigments may be introduced into the system and cause grave accidents. Many of the green wooden toys are painted with Schweinfürt green loosely applied, the colour being mixed with water only and smeared on the wood, instead of being more securely fixed upon the material by means of oil or varnish; and when one remembers the instinctive habit of young children to carry to their mouths whatever their hands contain, the liability to injury is at once apparent. Moreover, children's hands are always moist, and this moisture can readily dissolve and detach the loosely applied colour. The hands thus soiled are put to the face, and, as likely as not, in the mouth. This custom of using the metallic colours on toys is the more reprehensible since it is wholly unnecessary, or, if any colour is desirable, vegetable pigments should be substituted. Chevallier cites two cases of acute arsenical poisoning in children from the source alluded to, and remarks "It is a matter of surprise that other cases have not been brought to the notice of the public, since children are so often seen playing with those cheap toys, with their hands abundantly daubed with yellow, red, and green."*

The boxes of water-colours which are in such common use as a plaything for children, contain generally two blocks of green paint, one being of a dark and the other of a light shade. The latter consists of arsenical green. A tablet of this kind, weighing 38·26 grains, was analysed for the writer by Mr. A. H. Pearson at the laboratory of the Massachusetts Institute of Technology, and found to contain 8·89 grains of arsenic. A child in using these paints will frequently carry the brush to his mouth, in order to moisten it with saliva before applying it to the colour, and sometimes the paint is itself touched directly to the tongue. It is marvellous that more frequent cases of poisoning from this source do not occur, because not only the green colour, but others also of the blocks, are composed of matters of a positively harmful nature. Must it not be considered as hardly less than criminal in the manufacturers of toy paint-boxes to distribute a colour containing so large a proportion of one of the most irritant poisons?

It has happened that children, too young to know the use or nature of these paints, have eaten portions of them, and have been seriously poisoned in consequence. Such an instance was reported in 1859 by Dr. Rose; the child took only a small fragment of a green paint, and in half an hour he became cold, pulseless, and fully collapsed. Only by the vigorous application of the proper antidotes to arsenic was the child's life saved.† Four cases, precisely analogous in character, are recorded by Chevallier.‡

III. The arsenical pigments are sometimes used in the *inside painting of houses*, and in this relation they merit a single word. The dangers to health arising from this source are, of course, comparatively unimportant in America, where taste and fashion prescribe the general use of white-lead for these purposes of house painting. In some parts of Europe, however, the use of mineral green has been deemed a matter of sufficient importance, on account of its extent, to warrant an investigation into the effects which may occur. M. Kirchgässer, of Cohlentz, published, in 1867, the results of his researches on this subject, and demonstrates the deleterious effects of habitually staying in rooms on whose walls is a coating of arsenical green. The symptoms in such cases are those of chronic arsenical poisoning, and they are identical with those due to exposure under other circumstances; the most characteristic are excessive debility, intermitting pains, cold extremities, a cachetic aspect, and sometimes the appearance of brown patches on the skin.

Dr. Lorinser also asserts his unqualified opinion that chronic arsenical poisoning may occur in consequence of the occupancy of rooms whose walls are painted green, and which owe their colour to the arsenical pigments. Numerous cases occurring in his own experience are cited to demonstrate his statements.‖

The following instance illustrates how accidents may arise through inadvertence from the use of arsenical green paint. The experience is not improbable in our own community where the paint is sometimes used on

* *London Med. Times*, 1849, p. 107.
† *London Med. Gazette*, vol. 43, p. 304.
‡ For numerous other cases, see Taylor "On Poisons," 2nd Ed., p. 431.
‖ *Annales d'Hygiène*, new ser., vol. xii., p. 69.

* *Annales d'Hygiène*, 2nd ser., vol xix., p. 304.
† *Lancet*, 1859, vol. i., p. 237.
‡ *Annales d'Hygiene*, new ser., vol. xii., p. 94.
‖ *Wiener Med. Wochenschr.*, 1859, Nos. 43 and 44.

shelves and such other limited surfaces. A distinguished English chemist, Professor Taylor, observed, adherent to the under crust of the loaf of bread which had been placed one morning before him for breakfast, certain well-marked patches and streaks of a green colour, having the appearance of green mould. He removed some of the suspicious matter, and, subjecting it to analysis, proved it to be composed of "Scheele's green, containing about 50 per cent of arsenic." There was enough on one of the loaves to have killed an infant. On inquiry, it was ascertained that the baker, from whom the bread had been purchased, had just had his shop newly decorated, and there were eight long shelves (holding some hundreds of loaves) painted a bright grass-green colour, top, front, and sides. A number of the loaves were examined in succession, and it was found that they were all similarly stained. They had been placed while warm on the shelves, and had absorbed a quantity of the freshly-applied poisonous pigment. "The baker expressed his ignorance that there was arsenic in the paint; but the painter, who was summoned, took the matter more coolly and professionally, remarking that it was impossible to get a good green without arsenic, that he had used it for many years, and he had never heard of anyone being killed by it." The author remarks: "It is easy to conceive that an accident of this kind, if undetected, might lead to serious results, and perhaps to very erroneous suspicions."*

A case analogous to the foregoing occurred in Vienna. An entire family were made seriously ill by eating strawberries which had been kept a few hours in a box whose inner surface was painted green. The paint, on analysis, was found to be coloured with arsenite of copper.†

IV. Every person must be familiar with the appearance of the brilliant *green paper* which is used so extensively for covering paste-board boxes, for show-cards, for tickets, for wrappers, for lamp-shades, and for a great number of similar purposes. This paper owes its bright tint in all these forms to the presence of arsenite of copper. It contains a large amount of the poisonous material in proportion to its weight.

The accidents to which this method of employing arsenic may give rise are, as will readily be seen, chiefly of an acute order, and grow out of the danger, to which children are especially liable, of swallowing the poison in the manner alluded to in connection with toys. The matter has received particular attention in France, and the use of arsenical green paper for the purpose of enveloping articles of food, confectionery, and the like is absolutely prohibited. In his instructions to his subordinate officers, the Prefect of Police of Paris applies the interdiction of these papers to "bags, envelopes, boxes, or labels as used by all dealers in provisions or articles of food whatsoever."‡

Such a sweeping proscription would certainly appear impracticable in our own community, but it serves to illustrate the magnitude of the subject as it is regarded in other countries. Certainly the very general use of the material in question, under a great variety of forms, must be obvious to the most casual observer, and when the eye once becomes accustomed to the characteristic shade, and looks for it, it is surprising to observe to what a multiplicity of uses the paper is applied. It will not be unprofitable, therefore, to utter a word of warning concerning the dangers which are possible, and to cite cases which exemplify them.

Perhaps the most reprehensible use to which the green paper is put is as a wrapper to packages of confectionery, chocolate, and the like, a practice which is becoming too common. On of the most reputable of the confectioners of Boston displays in his windows and on his shelves, with other confectionery of his own manufacture, rolls of lozenges enveloped in the bright green paper; and the same custom is to be repeatedly observed in other stores. Children, readily allured by the bright tint, obtain this candy, and if they do not swallow a portion of the poison with the sweatmeat, are not generally unready to put the paper wrapper to their mouths, child fashion. A case is recorded by Chevallier in which a child was poisoned in this manner by a piece of green paper. The mother of the child had given him a fragment of chocolate, around the end of which, for the sake of neatness, she had wound a portion of the paper in which it was originally enveloped. In sucking the candy, the child also took into its mouth some of the colouring matter from the paper, and narrowly escaped death in consequence.*

An accident like the following is likely to occur at any time to an organism equally sensitive to the action of poisons, where price-cards covered with arsenical green are so freely used:—

"A lady purchased a quantity of prunes, of which she cooked a portion. Soon after eating some of them she was attacked with vomiting, which continued several hours. Not suspecting the cause of her illness, she took more of the prunes, and suffered a recurrence of the symptoms. Then it was noticed, on careful search for the cause of her trouble, that some of the fruit was stained with green. On returning the prunes to the grocer, he recognised the fact that the colour proceeded from a green price-card which had rested on them; the fruit, being moist, had taken up a portion of the colouring matter from the paste-board. The pigment was found to consist of Scheele's green."†

The instance which follows is also suggestive of a quite common exposure:—

"A watchmaker had a very troublesome and irritable ulceration of the mucous membrane of the mouth. The smarting and annoyance were almost intolerable, and became much increased in the evening, when the lips swelled and became so painful that eating, or even speaking, could scarcely be indulged in. In prosecuting his work, he was in the habit, in the evening, of using a gas-light, before which, to protect his eyes, he had a bright green paper shade. On analysis, the colour of the shade was found to be due to the presence of aceto-arsenite of copper (Schweinfürt green). The heat from the light was believed to have decomposed a portion of the arsenical pigment, producing the characteristic odour and causing the acute symptoms in the workman. Speedy recovery followed the disuse of the shade."‡

In 1861, the following case occured in Boston, and was reported in one of the local medical societies:—A young child, in playing with a small green concert ticket, put it to his mouth, and detached and swallowed a portion of the pigment. Violent symptoms followed. A duplicate ticket was analysed quantitatively by Dr. C. T. Jackson, and was found to contain in its green coating nearly 2 grains of pure arsenic.‖

(To be continued).

* *Medical Times and Gazette*, April, 1854, p. 326.
† *Oester Med. Wochensch.*, 1841.
‡ *Circulaire aux Com. de Police de Paris*, Nov. 28, 1855.

* *Annales d'Hygiene*, vol. xix., p. 304.
† *Ibid.*, vol. xii., p. 71.
‡ *Lancet*, Jan. 7, 1860, p. 8.
‖ *Boston Med. and Surg. Journ.*, vol. lxiv., p. 121.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.§

By Dr. F. CRACE CALVERT, F.R.S.

Alkanet.—The root of the *Anchusa tinctoria* contains a beautiful red resinous principle, to which Professor Bolley assigns the formula $C_{35}H_{40}O_8$, which is insoluble in water, but soluble in alcohol, ether, and bisulphuret of carbon. To all these solvents it communicates a fine purple colour, which becomes blue on the addition of an alkali. It is not at the present day employed as a dye-stuff, its chief uses being in pharmacy to colour medicines;

§ The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

in perfumery, to colour oils and greases; and in domestic life to give a tint to the lime-wash used for the walls of private dwellings.

Safflower.—Although this dye-stuff has lost much of its value since the discovery of the aniline colours, it is still extensively used in Lancashire for the production of peculiar shades of pinks for the eastern markets. It is also used for dyeing red tape, and I know no more striking instance of red-tapeism than the love which is shown for this particular dye by the users of this article. Much cheaper pinks can be produced from aniline, and, notwithstanding that many times the attempt has been made to introduce them, it has in every instance failed, because the exact shade has not been attained.

Safflower is the bloom of a peculiar thistle called *Carthamus tinctorius*, which is cultivated in France, Egypt, Spain, Italy, and India. In France and Spain, the small flowers composing the heads of the thistle are picked off and dried in the shade, whilst in Egypt and India they are squeezed, washed with cold water to remove useless materials, slightly pressed into lumps, and dried in the shade; the latter have about double the value of the former. The safflower so prepared only contains 3 to 6 parts per 1000 of the colour-giving principle.

This principle has received the name of carthamic acid, and has the formula $C_{14}H_{16}O_{14}$. A solution of this acid, when dried on a polished white surface, leaves a varnish, having a beautiful red colour by transmitted light, whilst it assumes the iridescence of cantharides when seen by reflected light. It is insoluble in water and ether, but soluble in alcohol. This solution becomes yellow on the addition of sulphuric, nitric, or hydrochloric acid. It is also turned yellow or orange by weak alkalies, and the colouring matter in this latter solution undergoes rapid alteration if exposed to the atmosphere. It is owing to the fugitive nature of the colour, and its easy modification by acid and ammoniacal vapours, that the delicate pinks produced from safflower have been so successfully replaced by the pink aniline dyes.

To prepare carthamic acid, safflower is introduced into bags and washed, till a yellow colouring matter which it contains is removed. It is then mixed with water, to which is added 15 per cent of the weight of safflower taken of crystallised carbonate of soda. After two hours' maceration, the liquor is run off, and cotton yarn dipped in; then lemon juice or citric acid is added to liberate the carthamic acid, which fixes itself on the yarn. Up to this point, the process is the same as that adopted in dyeing fabrics, but to obtain the acid, it is necessary to treat the washed cotton a second time with carbonate of soda, which dissolves out the carthamic acid, leaving a second yellow colouring-matter fixed on the cloth. The carthamate of soda thus obtained is decomposed by tartaric acid, and the carthamic acid falls as a brilliant red amorphous powder, which, when mixed with a little water, is sold as safflower extract, and when dry and mixed with ground talc, is employed as *rouge* by ladies.

There is a particular extract extensively used in dyeing, the preparation of which is a secret. Its value depends on the fact that the carthamic acid is rendered soluble in water.

Cochineal, Kermes, Lac-dye, and Murexide.—I shall now call your attention to four colours derived from the animal kingdom, namely, cochineal, kermes, lac-dye, and murexide.

The first three are distinct species of a peculiar tribe of insects called *Coccina*. The females, from which alone the colouring-matter is derived, form a mass nearly destitute of limbs, and remain attached to one spot on the plants infested by them. The males, on the contrary, are very minute and really elegant creatures, furnished with a single pair of filmy wings. The real cochineal is called *Coccus cacti*; kermes, *Coccus ilicis;* and lac-dye *Coccus lacca* or *ficus*. They all contain the same colouring principle. Although the dyes derived from some species of these insects were well-known to the ancients, and were much used in Persia and India, the true cochineal has only been known in Europe since the discovery of America by the Spaniards; and since the year 1830 only has it been propagated in the Canary Islands, the island of Teneriffe, Java, and Algiers. The best qualities are still obtained from the republic of Honduras.

The *Coccus cacti* lives on a species of cactus called the *nopal* or *Opuntia cochinilifera*. This plant is indigenous to Mexico, where it grows in the wild state; and from it large quantities of cochineal are collected. It is also extensively cultivated by the native Indians, who often have plantations containing 60,000 plants. The cochineal obtained from the two sources is of different quality; that from the cultivated plant is much superior, and is called *mestique;* that collected from the wild plant is called *sylvestra*.

I will now explain, in a few words, how cochineal is propagated and prepared for market. In the month of May, in the flat lands, and in November in the mountainous districts, the Indians take the stems of the cactus, which they have preserved from a previous crop, and remove from them the young female insects, which are placed on the growing plants, where they grow and multiply with great rapidity. After a period of about three months, the insects are collected into small tin dishes, so formed as to enclose the bottom part of the plant, and by means of a small brush they are swept from each stem successively into it. They are then destroyed, either by being thrown into hot water and afterwards dried in the sun, or in stoves, which gives the black cochineal, called *zacatilla*, or they are placed in a bag and stoved at once, which leaves upon them that peculiar lustrous appearance which characterises the silver-white cochineal, called *blanco*. Although 1lb. of cochineal contains 70,000 insects, there are millions of pounds imported into Europe every year.

If one of the dried insects be placed in warm water it swells, and takes a hemispheric form, when its structure can be seen. If it is pressed between the fingers, thousands of little red grains are exuded, which, if placed under the microscope, are seen to be minute cochineal insects.

The colouring-principle was first isolated in an impure state by Pelletier, who considered it to be an azotised compound. MM. Arppe and Warren de la Rue, however, found that it contained no nitrogen, and that it had the formula $C_{14}H_{14}O_8$. As it had distinctly acid properties, they gave it the name of *carminic acid*. M. Schützenberger proved that carmine is composed of carminic acid and an organic azotised base called *tyrosine*.

MM. Arppe and Warren de la Rue obtain crystallised carminic acid by the following process. The cochineal is treated with ether, to remove fatty matters, then boiled in water. An acid acetate of lead is added to the solution thus obtained, which precipitates an insoluble carminate. This, after being washed carefully, is decomposed with sulphuric acid, the carminic acid being liberated. The aqueous solution is evaporated to dryness, and the mass treated with alcohol, which, on evaporation and cooling, yields it as a crystalline mass.

As shown by the above process, carminic acid is insoluble in ether, but soluble in water and alcohol. It is dissolved without decomposition by concentrated sulphuric and hydrochloric acids. Carminic acid yields on fabrics, especially on wool, one of the fastest colours known, light and air having no action on it. Chlorine, however, easily destroys it. An aqueous solution of the acid gives the following characteristic reactions. With caustic alkalies, it gives a beautiful crimson-red colour; with oxymuriate of tin, it gives a red precipitate; and with cream of tartar or oxalate of potash, an orange-red precipitate. Alumina removes the whole of the colouring-matter from an aqueous solution. As cochineal is an expensive dye-stuff, it is subject to much fraud and adulteration. One of the most common frauds is practised at Nismes and

other places where perfumery is largely prepared. The cochineal in those localities is put into water for a short time, by which a part of its colour is extracted; it is then dried, and either sold as black cochineal, or placed in a sack and shaken with talc or sulphate of lead, and sold as white cochineal. This fraud is easily detected by grinding the cochineal, and mixing it with water, when the talc or sulphate of lead falls to the bottom. Good cochineal does not leave above 5 or 6 per cent of ash.

It is often advisable before buying cochineal to determinate its tinctorial power. This may be ascertained by two or three methods. In the first, equal weights of the cochineal to be assayed, and of one of known value, are treated with alcohol or a solution of alum. The solutions thus obtained are poured into tubes, and placed in a colorometer. This is an oblong box, which has two apertures at each end and two on the top, in a direct line with the end apertures. The tubes are placed through the openings on the top, and, on looking through the end apertures, any difference in intensity of colour between the two liquids can be observed. If a difference is detected, alcohol or water is added to the stronger liquor until there is perfect uniformity of tint. According to the amount of dilution required is the relative value of the cochineals.

A good process was published by the late Dr. Penny, of Glasgow. It consists in exhausting a grm. of cochineal with 50 grms. of potash solution, and this extract is further diluted with 100 grms. of water. The solution thus obtained is mixed with a graduated solution of ferricyanide of potassium (1 grm. of salt to 200 grms. of water) till its colour changes to a dark brown. A solution of bleaching-powder of known strength can also be used for the same purpose. The best method consists in dyeing equal surfaces of flannel in a bath composed as follows:—

For Scarlet Tints.

	Grms.
Water	1250
Cream of tartar	2
Tin composition	2
Cochineal	1

For Crimson Tints.

	Grms.
Water	1250
Cream of tartar	0·75
Alum	1·50
Cochineal	1

The pieces are then washed and dried, and, by a comparison of the relative intensity of shade, the value of the cochineal is determined.

The chief employment of cochineal is for dyeing wool, but it is also employed in calico printing to produce pinks and reds in steam styles.

It will no doubt be interesting to you to know how to determine whether a pink has been produced from a dyewood, a cochineal, or from madder. All these colours are destroyed by chlorine or bleaching-powder. A boiling soap solution destroys the wood pinks, communicates a crimson hue to the cochineal dye, and brightens the madder colour. Dipped in a rather dilute solution of hydrochloric or sulphuric acid, fabrics dyed with cochineal are not affected, while those dyed with madder or woods assume a yellow tint, which becomes purple when placed in milk of lime. These cloths, however, if subsequently soaped, will yield their colour if dyed with wood, but not if dyed with madder.

Ammoniacal Cochineal.—When 1 part of ground cochineal is left in contact with 3 parts of ammonia for several weeks, a chemical action ensues, by which the ammonia loses one equivalent of hydrogen, which unites with an equivalent of oxygen of the carminic acid, giving rise to water and an amide compound, carminamide. Adopting M. Schützenberger's formula for carminic acid, the change may be thus represented:—

Carminic Acid. Ammonia. Water. Carminamide.

$$C_9H_8O_5 + NH_3 = H_2O + C_9H_9NO_4.$$

This compound is also used for dyeing, but before employing it for this purpose it is necessary to add 4 per cent of alumina, in the state of jelly, to the mixture described above. The mass is then slowly evaporated to the consistence of a thick paste. By this means all excess of ammonia is expelled. This preparation is used for dyeing silk, and to produce violet and mauve colours on woollen goods.

(To be continued.)

TECHNOLOGICAL EXAMINATIONS.

On Saturday, the 20th inst., Prince Arthur presided at a conference at the Society of Arts on the promotion of technical education among the working classes of this country. The assembly included the Lord Chancellor, Sir John Pakington, M.P., Lord Henry Lennox, M.P., Lord De l'Isle and Dudley, Lord Clarence Paget, Lord Alfred Churchill, Major-General F. Eardley-Wilmott, Admiral Ommanney, Professor Huxley, Dr. Lyon Playfair, M.P., Dr. Frankland, Professor Tennant, Captain Donnelly, Dr. De la Rue, Captain Galton, Professor Hughes, and Professor Goodeve.

The Secretary read the Report of the Council, which stated that if this country was efficiently to maintain its manufacturing supremacy in the markets of the world, the technical education of our artisans must be improved; and the Council were of opinion that technological examinations would be of great use in furtherance of this end. The Council had had before them a proposal by Captain Donnelly, that the Society of Arts should establish examinations in the science and technology of the various arts and manufactures of this country, and they proposed to hold the first technological examination in 1873, when the subjects would be the manufacture of cotton and paper.

His Royal Highness concluded a practical and able speech by saying:—The Society of Arts are endeavouring to encourage, among those who are practically employed in various industries, the study of art, and an accurate knowledge of its application in each branch of manufacture. The Society will not, however, attempt to teach the practice of those arts. Their object is rather to lay a sound foundation of all the principles on which those practices may be carried out to the best advantage. The Society wish and desire to give certificates, prizes, and scholarships, to those who show that to practical skill as workmen they have added an accurate knowledge of natural principles in those matters. I am certain the necessity and advantage of combining scientific principles with practice will be seen by all. I only wonder that we are but just beginning to undertake this task. The machinery for these technological examinations already exists, and, in fact, the skeleton of industrial Universities is ready to our hands. What we now require is funds to clothe it with and give it life, and to enable it to carry out its work—that is, to obtain sufficient prizes to encourage and reward the deserving youth of this country. If others would only do what Sir Joseph Whitworth has done by his noble endowment for mechanical engineering, we might soon hope to see our most sanguine expectations realised.

The Lord Chancellor briefly moved the first resolution, which approved of the proposed scheme of technological examinations, and considered it well worthy of general support, with the view of meeting the admitted general deficiency of technical knowledge in this country.

Dr. Lyon Playfair, M.P., seconded the resolution, which was carried.

Mr. Watney, the Master of the Mercer's Company, moved that this meeting trusts the advancement of technological knowledge in the manner proposed may be

viewed by the City Guilds, and other like bodies, as an object well worthy of their support and material assistance. He expressed his belief that the Livery Companies were not, as was generally imagined, opposed to the resuscitation of technical education, and would support any good scheme with that view.

Dr. Warren de la Rue seconded the resolution, remarking that if the City Guilds would only contribute a small portion of their funds towards raising the scientific standard of English workmen, it would prove a good investment for the country.

The resolution was carried unanimously.

Sir J. Pakington, in moving the next resolution, which directed the formation of a committee, consisting of the masters of the city companies, the leading manufacturers and scientific professors, and the members of the Society of Arts, urged that the elementary education of the people having been provided for, there was now no longer any excuse for further delaying the consideration of the important question of systematic technical instruction, and that, unless the matter was vigorously taken up, Germany and France would steal ahead of us, while we were supinely thinking we were guiding the manufactures of the world.

Lord De l'Isle and Dudley seconded the resolution, which was carried.

A cordial vote of thanks to Prince Arthur for presiding brought the proceedings to a close.

NOTICES OF BOOKS.

A Handbook of Chemical Technology. By Rudolf Wagner, Ph.D., Professor of Chemical Technology at the University of Wurtzburg. Translated and edited from the Eighth German Edition, with extensive additions, by William Crookes, F.R.S., &c. With 336 engravings on wood. London: J. and A. Churchill. 1872.

It cannot be denied that, as regards good handbooks on scientific subjects, we are greatly indebted to the zeal and active industry of the Germans; and as regards works on technology, this is still more prominently the case, for in no other civilised country has there been published a work of greater magnitude or intrinsic value than the celebrated "Technologische Encyclopedie" von Prechtl.

The publication of an English edition of the work before us will, we think, be hailed with pleasure, especially as the subject of technical education is now occupying prominent attention. The translator opens his preface with the following sentence:—"The several editions of Professor R. Wagner's 'Handbuch der Chemischen Technologie' have succeeded each other so rapidly that no apology is needed in offering a translation to the public." In order to give our readers some insight into the scope of this volume, we transcribe from the contents the following particulars:—*Division* I.—Chemical Metallurgy, Alloys, and preparations made and obtained from Metals—Iron; Pig or Crude Iron; Malleable, Bar, or Wrought-Iron; Steel; Iron preparations; Cobalt; Nickel; Copper; Lead; Tin; Bismuth; Zinc; Cadmium; Antimony, preparations in technical use; Arsenic; Quicksilver, or Mercury, and its preparations: Platinum; Silver; Gold; Manganese; Permanganate of Potassa; Magnesium; Electro-Metallurgy. *Division* II.—Crude Materials and Products of Chemical Industry—Carbonate of Potassa; Saltpetre; Nitrate of Potassa; Nitric Acid; Technology of the Explosive Compounds; Gunpowder, and the Chemistry of Fireworks or Pyrotechny; Nitroglycerine; Gun-Cotton; Common Salt; Manufacture of Soda; Native Soda; Soda from Plants, or Soda-Ash; Soda prepared by Chemical Processes; Preparation of Iodine and Bromine; Sulphur; Sulphurous and Hyposulphurous Acid; Manufacture of Sulphuric Acid; Sulphide of Carbon; Hydrochloric Acid and Sulphate of Soda; Bleaching-Powder and Hypochlorites; Alkalimetry; Ammonia and Ammoniacal Salts; Soap Making; Boracic Acid and Borax; Production of Alum, Sulphates of Alumina, and Aluminates; Ultramarine. *Division* III.—Technology of Glass, Ceramic Ware, Gypsum, Lime and Mortar—Glass Manufacture; Ceramic or Earthenware Manufacture: (1) Hard Porcelain, (2) Tender Porcelain, (3) Stoneware, (4) Fayence Ware, (5) Common Pottery, (6) Brick and Tile Making; Lime and Lime Burning; Mortar: (A) Common or Air-Setting Mortar, (B) Hydraulic Mortar; Gypsum and its preparation. *Division* IV.—Vegetable Fibres and their Technical Application—The Technology of Vegetable Fibre; Flax; Hemp; Cotton; Paper Making: (A) Hand Paper, (B) Machine Paper, (C) Pasteboard and other Paper; Starch; Sugar Manufacture; Cane Sugar; Beet-Root Sugar; Grape Sugar; Fermentation; Wine Making; Beer Brewing; Distillation of Spirits: (A) Preparation of a Vinous Mash, (B) Distillation of the Vinous Mash; Bread Baking; The Manufacture of Vinegar: (A) Preparation of Vinegar from Alcoholic Fluids, (B) Preparation of Vinegar from Wood Vinegar; The Preservation of Wood; Tobacco; Technology of the Essential Oils, Resins, and Caoutchouc Substances; Cements, Lutes, and Putty. *Division* V.—Animal Substances and their Industrial Application—Woollen Industry; Silk; Tanning; (1) Red or Bark Tanning, (2) Tawing, (3) Samian or Oil-Tawing Process; Glue Boiling; Manufacture of Phosphorus; Requisites for Producing Fire; Animal Charcoal; Milk; Meat. *Division* VI.—Dyeing and Calico-Printing—On Dyeing and Printing in General: (1) Aniline Colours, (2) Carbolic Acid Colours, (3) Naphthaline Pigments, (4) Anthracen Pigments, (5) Pigments from Cinchonine; Red Pigments occuring in Plants and Animals; Blue Dye Materials; Yellow Dyes; Bleaching; Dyeing of Spun Yarn and Woven Textile Fabrics; The Printing of Woven Fabrics. *Division* VII.—The Materials and Apparatus for Producing Artificial Light—Artificial Illumination in General: (1) Artificial Light from Candles, (2) Illumination by means of Lamps, (3) Gas, Paraffin, and Solar or Petroleum Oils. *Division* VIII.—Fuel and Heating Apparatus—Fuel in General; Wood; Peat; Carbonised Peat; Brown-Coal; Pit Coal, or Coal; Petroleum as Fuel; Coke; Artificial Fuel; Gaseous Fuel; Heating Apparatus; Heating Dwelling-Houses; Steam-Boiler Heating and Consumption of Smoke.

This is a mere outline of the subject-matter treated of in this work. It should be borne in mind that the book, to which valuable additions have been made, is intended to be a class-book and a guide to both students and teachers of technology; but manufacturers, merchants, and scientific and practical chemists, will meet with valuable information, while for more extensive details the larger work of Dr. Wagner, which consists of five volumes in the German language, may be consulted. We sincerely hope that the study of technology may soon become in this country, as it already is in Germany, an important branch of education in our universities and colleges.

Second Annual Report of the Deputy Master of the Mint. 1871. Presented to both Houses of Parliament by command of Her Majesty. London: Eyre and Spottiswoode. 1872.

At the close of the year 1870, the Assay Department of the Mint underwent reorganisation, the new arrangements involving the abolition of the offices of non-resident assayers, and a return to the ancient system under which all bars when alloyed and ready for coinage are assayed within the Mint itself. To render possible the exercise of a more direct and efficient control over many details upon which the accuracy of coining in a great measure depends, a second Assay Office has been established, and materially contributes to a more rapid execution of the coinage. The advantages of the change are abundantly

shown in the memorandum of Mr. W. Chandler Roberts, the Assayer, annexed to the report of the Deputy Master.

The last year presented some severe attacks upon the resources of the various departments of the Mint, for whereas the yearly average of the coinage of gold is £5,000,000, the demand for gold coin rose to the extraordinary amount of £9,798,735 for British coins alone. This enormous increase has been met with more than average success under the disadvantage of new arrangements, while several points have been gained of material value in the improvement of the gold coinage. For instance, "in the process of annealing additional experience has been acquired as to the manner in which all discolouration of the blanks by the oxidising action of the air may best be avoided, and the result has been an increased brilliancy on the surface of the coins, which contrasts not unfavourably with the hue of pieces to which the operation of blanching has been applied."

The operations of "minting" are far from being of an entirely mechanical nature, for the mechanical processes must be considered as subsidiary to the formation of an alloy of base and precious metals in definite proportions. Moreover the composition of the alloy after melting must be ascertained with the utmost accuracy, and again when the alloy has been converted into coin. Mr. Chandler Roberts has in consequence of these requirements introduced into the New Office the volumetrical method of assaying silver, and the result under his careful management, has in every detail been satisfactory. Mr. Roberts also has found that modern improvements in the process of refining having rendered it possible to extract with profit all the gold in excess of 2 grains in the lb. troy, made experiments to ascertain whether the gold was present in sufficient quantity to render desirable its extraction from the old silver coin now in course of withdrawal from circulation. The results have shown that half-crowns issued during the period between the years 1760 and 1837, contain 4·07 grains of gold in the lb. troy. Accordingly arrangements have been entered into with Messrs. Johnson and Matthey to effect the extraction.

Mr. Roberts's researches on the best method of treating "brittle" gold are very valuable, and we quote the memorandum *in extenso*. "In my preliminary reports upon the method of toughening brittle gold, dated November 19, 1869, and April 20, 1870, respectively, I detailed the experiments which enabled me to recommend that chlorine gas should be employed for rendering ductile gold of which the intractable character had escaped detection when the ingots were imported into the Mint.

"The amount of gold set aside as unfit for working during the coinage of £6,500,000, which was completed in July, 1871, amounted to 40,000 ozs., and I now proceed to describe the method by which this gold was treated; but as the details are necessarily technical, it may be well to repeat that brittleness in gold is usually due to the presence of minute traces of foreign metals, and that these metallic impurities are eliminated as chlorides by the passage of chlorine gas through the molten metal.

"In the melting of gold, as ordinarily practised in the Mint, crucibles of graphite are employed, but such crucibles are not well adapted for use in the treatment of gold by chlorine gas, as the gases evolved from them exercise a reducing action upon the chlorides. It is therefore advisable to substitute crucibles of fire-clay for those of graphite, but, as the workmen of the Mint are unaccustomed to the manipulation of fire-clay crucibles, I was obliged to avail myself of the crucibles ordinarily in use, with the slight inconvenience entailed by the necessity of prolonging by some minutes the time during which the gold is exposed to the action of the chlorine.

"About 1100 ozs. of gold were melted in each crucible, and the chlorine gas was passed through each in succession, the time during which the metal was exposed to the gas varying from 5 to 7 minutes. The gold was found to be perfectly tough, and was re-assayed and again melted with the amount of copper required to form standard gold.

"I append a statement indicating the result of the operations upon 40,000 ozs. of standard gold.

	Ozs.	Ozs.
Amount of initial loss		40·360
Amount of gold recovered from ground up crucibles, borax, &c.	15·507	
Amount of copper and base metal proved by assay to have been eliminated as chloride.	24·746	
		40·253
Loss		0·107

It will be seen that the loss of gold on toughening 40,000 ozs. was only 1-10th of an ounce, and I submit that the experience gained by operating upon an extended scale has fully justified the opinion which I formed from preliminary experiments, and that the process may now be considered to have fairly taken its place as an operation of minting."

The result of these carefully conducted processes is that when during the last trial the jury selected coins assaying portions of metal from every part of the coin, their verdict was in the highest degree satisfactory, not, withstanding the increased stringency of the examination.

It is interesting as indicating the accuracy attained in the preparation of the gold-copper alloy, that analysis of the assay reports on 1,000,000 of gold coin issued in the ordinary course between the 2nd and 18th of November, 1871, shows that:—

		Per mille of Gold.
1·33	per cent of the coins contained	916·2
6·00	,, ,, ,,	916·3
6·66	,, ,, ,,	916·4
16·66	,, ,, ,,	916·5
15·33	,, ,, ,,	916·6
27·33	were of the exact standard.	916·666
13·33	,, ,, ,,	916·7
9·33	,, ,, ,,	916·8
2·66	,, ,, ,,	916·9
1·35	,, ,, ,,	917·0
99·99		

Mean composition of the coins { 916·61 gold. 83·39 copper.

1000·00

The limits of the "remedy" permitted by law being 914·6, and 918·6 parts in 1000.

These results are not only good, they are remarkable; for according to ordinary methods of chemical analysis, the deviation from the standard would only amount to a variation of 0·2 per cent, fully in agreement with the remarks of M. Le Jacobi, who represented the Russian Government at the International Monetary Conference held in Paris in June, 1867, and who said, "the tolerance is not an arbitrary stipulation, but is the limit of errors which belongs to every thought, to every chemical analysis, to every composition of alloy, and, as such, depends on the precision of the balances, and the methods employed in the fabrication of money; it may be determined rigorously by applying the calculus of probabilities."

This observation has been borne in mind by Mr. Roberts throughout the important improvements he has effected in the chemical processes pertaining to minting, the consequence being the attainment of an almost unsurpassable standard of accuracy in the composition of the coinage now in circulation.

It may not be uninteresting to shortly sketch the history of the office with which Mr. Roberts is so ably connected. According to Lowndes, the office of "miles argentarius," or assayer of silver, was established in 1180; and in 1222 the office of King's Assayer, whose report was a guarantee to the Crown and to the public of the fineness of the coin, and who was originally also the Warden of the Mint. During the

period between 1544 and 1571 the operations of minting were performed by contract; and it was not until 1851 that the contract system was entirely abolished, and with it the office of King's Assayer, the verification of the coinage being entrusted to eminent chemists having no office in the Mint. The inconvenience of this arrangement led to the re-establishment of an Assay office for verification, and we think that our readers generally will concur with us in thanking Mr. Roberts for the diligence and care he has bestowed upon this department.

CORRESPONDENCE.

PROPOSED ASSOCIATION OF MANUFACTURING CHEMISTS.

To the Editor of the Chemical News.

Sir,—I, with your other correspondents, was pleased to see "Frank's" suggestion for an Association of Manufacturing Chemists, and your favourable remarks on same. There is no doubt such an association is wanted, and if formed, and well conducted, would be invaluable to manufacturers, and might be the means of saving thousands of pounds spent in useless experimental plant. As the provincial chemical societies, however, are, to a great extent, occupied with technical chemistry (though they do not meet the want), and do not show any remarkable signs of vitality, I am only afraid that another, and independent society, might fall into the same lethargic condition. To avoid this, I would suggest the amalgamation of all, or as many as possible, of the existing societies, such as the Chemical Societies, Association of Gas Managers, Alkali Association, &c. Of course the combination formed therefrom would require to take in a very large field, but it would be all the more likely, in my humble opinion, to flourish. With your correspondent Mr. Wilkins, I hope that the Association, if formed, will take in as members those gentlemen of the engineering profession who give a portion of their time to the study of chemical plant. For my part, and as a manager of chemical works, I think a knowledge of engineering quite as essential as a knowledge of chemistry for all those who superintend chemical works. Besides, this has been hitherto so disregarded that I am sure there might be a very great saving in the cost of all chemical plant. And why should we not be able, after a time, if the Association lived and flourished, to start some form of college devoted to the study of the principal things required in the conducting of chemical works?

In conclusion, I will only say a word or two in confirmation of what Mr. Hart says about the narrow-minded policy of secrecy amongst manufacturers dying out. Such is clearly the case, and all are willing to give others the benefit of their experiences, if there is a proper and legitimate medium for doing so. As an example, I may refer you to the two most valuable papers read by Mr. Gibbs before the Newcastle Chemical Society, and published in the *Transactions*, which I see you have had sent you. If one united Society can be formed to take in all branches (even to wages questions) of manufacturing chemistry, I feel sure it will be well supported; but establish another half and half affair only, and I fear it will never do much.—I am, &c.,

Black Ash.

[Since the publication of "Frank's" letter and our article on this subject, several correspondents have offered their assistance in the formation of the proposed Association, and letters containing many practical suggestions have appeared in our columns. We are informed that steps have been taken at Newcastle-on-Tyne to organise the Society, and we hope shortly to record the success of the preliminaries.—Ed. *C. N.*]

TESTING BLEACHING POWDER.

To the Editor of the Chemical News.

Sir,—I have found it very convenient, in the determination of chlorine in hypochlorite of lime (bleaching-powder), to use an *acid* normal solution of ferrous sulphate, and attach to the bottle, by a copper wire, a rod of zinc, which is immersed in the solution before using it, and reduces the ferric sulphate, that has been formed by the action of the air, to its pristine condition. In this way I believe a normal solution might be used for years. Of course it can be used equally well for the titration of any other oxidising agent, like permanganate of potash or bichromate of potash.

Hoping that this simple suggestion may be of use to some of your readers,—I am, &c.,

S. Cabot, Jun.

Merrimack Print Works,
Lowell, Massachusetts.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

American Journal of Pharmacy, July, 1872.

In addition to several important original papers relating more particularly to pharmacy and pharmacognosy, this number contains the following original papers and essays bearing upon chemistry:—

Cotton-Root.—Dr. E. S. Wayne.—This memoir contains the account of researches made with the root of the cotton plant *(Gossypium herbaceum)*, which is used medicinally in some portions of the United States as an emmenagogue, parturient, and abortive, and is said to promote uterine contractions with as much efficiency and more safety than ergot *(Secale cornutum)*. The author ascertained that it contained no propylamine or such alkaloids as ergotina and ecbolia, but a red-coloured resinous body was found, which is insoluble in alcohol, chloroform, ether, and liquid ammonia, but is soluble in solutions of caustic potassa and soda. This substance, which appears to be due to the rapid oxidation of a body met with in all parts of the plant, is termed by the author gossypic acid. The author incidentally mentions that cotton-seed cake (the mass left after pressing the oil out) contains more or less of this resin, and that if cows are fed upon it abortion is produced.

On Lobelina.—W. D. Richardson.—The alkaloid just named exhibits a light yellowish colour, and has a somewhat aromatic odour. It is specifically lighter than water, in which it is soluble; this solution has an extremely acrid taste; it turns turmeric-paper brown, and red litmus-paper blue. The alkaloid neutralises acids, and forms crystallisable salts, which are soluble in water, less so in alcohol, and sparingly in ether; the acetate of lobelina does not crystallise. One of the most interesting properties of this alkaloid is its decomposition by the aid of heat, either in the free state or as it exists in the herb; it is combined with lobelic acid in the herb and seeds. Boiling water is sufficient to deprive it of its characteristic acrid taste; on being combined with strong acids, lobelina is not so affected by heat, but on being simply exposed to air it undergoes a change, whereby it is rendered incapable of uniting with acids to form salts. The mode of preparation is described at great length.

Valuable Products Obtained from the Maclura Aurantiaca, Texan.—The author states the extract of the wood of this tree (a native of Northern Texas, locally known as Bois d'Arc and Osage orange, and cultivated for the purpose of forming hedges) yields with water a decoction used as a yellow dye, while the inspissated aqueous decoction is of such a beautiful yellow colour that it might be properly called aurantine. In addition to this colouring matter, the Bois d'Arc contains a large percentage of tannin; experiments made in Texas prove that hides are tanned much quicker with the wood of this tree than with oak-bark. The seeds from the fruit yield a bland limpid oil, which is used for burning in lamps and also for culinary purposes; this oil resembles olive oil in taste, and it maintains its fluidity at a low temperature.

Notes on American Asphaltum.—Dr. J. S. Newberry.—This essay treats, in the first place, on the origin of asphaltes, the opinion of the author being that all asphaltes are more or less perfectly-solidified residual products of the spontaneous evaporation of petroleum.

The chief asphalte deposits of North America (including Canada, New Brunswick, and California) are then briefly described. It appears that asphalte is found in large quantities and in different stages of formation, its origin from petroleum being very plainly exhibited in South California, where the accumulations of asphalte on the coast of Santa Barbara, San Luis Obispo, and other localities, have attracted the notice of all travellers visiting that region. When the asphalte drips from the cliffs, and forms a scum on the ocean off the coast, it is evaporated and oxidised, and then thrown upon the beach by the waves. In the neighbourhood of Chicago, Ill., the limestone formation is in some places saturated with a thick petroleum, which, on exposure to air, is converted into asphalte. At the conclusion of his paper the author says that, notwithstanding the large quantity of asphalte met with in the country alluded to, for practical purposes it will be cheaper and more convenient to bring the Trinidad asphalte to America, because the transport and working of the asphalte found there will be too expensive, and the quantity found in the island of Trinidad (a British colonial possession) is inexhaustible.

The Chili-Saltpetre (Nitrate of Soda) Deposits of Peru.—Dr. J. M. Maisch.—It appears that, in many localities of Peru, not only strata of nitrate of soda, but also of borax and other salts, are found, while occasionally a more or less thick stratum of guano is met with between the layers of salt. The mother-liquors left after the crude method of refining the nitrate of soda, yield large quantities of iodine.

Hydrofluoric Acid.—A. P. S. Stuart.—In order to overcome the well-known difficulty of removing from the platinum or leaden vessels the hard, compact, rock-like residue left after the mixture of fluor spar and sulphuric acid is heated for the purpose of evolving hydrofluoric acid, the author recommends to mix with the fluor spar an equal weight of gypsum and the proper quantity of sulphuric acid; the residue left, after the expulsion of the hydrofluoric acid, is then found to be of a pasty nature and is readily removed by water.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, May 19, 1872.

Testing and Verification of Alcoholometers and Areometers.—M. Collardeau-Vacher.—The first instalment of a memoir written to point out the necessity of testing the hydrometers in use for estimating the strength of alcoholic and other liquids, especially for excise purposes. There is added to this memoir a tabulated form exhibiting the density of alcohol (and mixtures of alcohol and distilled water) at 15°, and the corresponding alcoholometric degrees of Gay-Lussac'a hydrometer.

Oxyhydrogen Blowpipe.—M. Wiesnegg.—The description, illustrated by woodcuts, of apparatus suitable for smelting substances such as platinum, iridium, and other very difficultly fusible minerals.

Tinning with Zinc instead of Tin.—C. Mène.—The author calls attention to a fraud which, in France at least, seems to be on the increase, viz., that of using zinc instead of tin for the purpose of lining copper vessels, which are in general use for cooking purposes in France; zinc being readily acted upon by weak acids, vinegar, &c., yields poisonous compounds. In order to test the tinning, the author recommends the boiling of vinegar in the vessel; if the surface remains bright, genuine tin has been used, but, if the metallic surface becomes tarnished, zinc may be suspected to have been substituted, and further research will be required before using the vessel for cooking purposes.

Annales des Mines, No. 1, 1872.

This number contains the following original paper relating to chemistry:—

Abstract of the Chemical Analysis made at the Departmental Chemical Laboratory at Mezières.—E. Nivoit and E. Letrange.—A brief account of fourteen analyses relating to iron ores, limestones, marls, fire-clay, and a copper ore; all these minerals are chiefly of local interest, excepting a copper ore from Siegen (Province of Nassau, Prussia), the composition of which, in 100 parts, is—Hygroscopic water, 0·10; quartz, 6·60; copper pyrites, 32·32, consisting of—Copper, 11·56; iron, 9·93; sulphur, 10·83; carbonate of iron, 60·61.

Journal de Pharmacie et de Chimie, June, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

Researches on the Preparation of Atropine from Belladonna Leaves (Atropa Belladonna).—J. Lefort.—From the author's researches—chiefly instituted with the view of obtaining a more advantageous method of preparing atropine for pharmaceutical purposes—it appears that the leaves of this plant contain about 4·5 grms. of the alkaloid to the kilo., and the root from 2 to 5 grms. The preparation of the atropine is described at great length, the main features of this operation being the exhaustion of the dry leaves with boiling hot water to which 10 grms. of tartaric acid to the kilo. are added. The filtered fluid is evaporated to the consistency of a soft extract, which is next treated with alcohol; the alcoholic solution is again evaporated to the consistency of an extract, which is next treated with an ethereal solution of caustic potassa, from which solution the atropine is separated by means of dilute sulphuric acid; the sulphate of atropine is lastly decomposed by means of bicarbonate of soda.

Condensed Report on Artificially-Made Butter Prepared by M. Mège-Mouries.—F. Bondet.—This lengthy memoir enters into details of scientific researches made by the first-named author, upon which he has based a method of preparing from milk and fat (oleomargarine) a substance resembling and tasting like butter, which remains sweet for five months after having been made. The mode of preparation of this imitation of butter is described at length, and the reporter comes to the conclusion that in a sanitary point of view the preparation may, if properly prepared, be used with advantage instead of genuine butter, but that the artificially-made product should be designated as such, and put into casks or vessels distinctly bearing the name and address of the maker.

Programm der Königlichen Rheinisch-Westphälischen Polytechnischen Schule zu Aachen für den Cursus 1872-3.

We owe to the courtesy of the eminent director of this establishment the opportunity of again calling attention to the Royal Rhenish Westphalian Polytechnic School, founded by the munificence of H.M. the Emperor of Germany at the ancient capital of Lower Lorraine. The programme before us—a volume of 112 large octavo pages, exclusive of two large tabulated forms—is highly valuable. It should be understood that this institution is in reality a polytechnic university, and those who desire to attend the lectures and enter as students (students in distinction from persons who are usually called "Hospitanten," *i.e.*, those who attend lectures without intending to pass examinations or to receive certificates of efficiency) should have received a sound preliminary education. The course of instruction intended to be given at the Polytechnic School at Aachen from October 7th, is described, and a loose sheet is added containing hints for those who desire to attend the instruction of a polytechnicum, as it is properly termed. The lectures and practical instruction embrace no less than sixty-one different subjects, and include not only all matters relating to mathematics, geometry, and physical sciences, pure as well as applied, but also everything required by the civil and mechanical engineer, architect, industrial and technical chemist, metallurgist, mining engineer, &c. The Polytechnic School possesses excellent libraries, laboratories, workshops, museums, and collections of various kinds, and a catalogue is given of donations during the year from different countries and private individuals (123 in number). Among the donations specially alluded to, mention is made of a complete set of Specifications of Patents, presented to this school by the Right Hon. the Commissioners of Patents for Great Britain and Ireland. Space forbids us to enter into more details; we may, however, mention that 347 persons have attended lectures during second term, including 2 ladies and 260 actual students; 215 were Prussians, 41 natives of other States of the German Empire; 11 Netherlanders, 7 Russians, 6 Belgians, 6 Luxemburgers, 3 Hungarians, 2 English, 2 Norwegians, and 1 from Bohemia, France, Poland, Galicia, Italy, and Roumania, respectively.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 235, July, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following memoir:—

Metalliferous Mines of France, not including Iron Mines. A. Caillaux.—This essay contains valuable information relating to the history of the art of mining in, as well as to the mineral wealth of, France.

Report on a New Gazogene Apparatus contrived by M. Maldiné.—H. Bouilhet.—Illustrated by engravings, this paper contains the description of a greatly-improved gazogene.

Les Mondes, July 18, 1872.

Coal in Chili.—Rev. F. Moigno.—It appears that very rich seams of coal have been discovered in Chili and in localities not far distant from the seaboard.

German Society of Natural Philosophers and Physicians.—The annual meeting of this Association will be held at Leipzig from the 12th to 18th of August next.

Digitaline.—Dr. Roucher.—The author states that the result of his researches is, that the crystallised digitaline prepared by Nativelle, as well as that prepared by Homolle and Quevenne, is not an active and simple principle, but that both are very complex compounds, and that the elementary analysis of these substances is incorrect.

Saline Iodated Water of Salès.—Dr. Pietra-Santa.—This water is a native spring, situated near Alexandria (Piedmont, Italy); it is stated to possess great medicinal virtues, and to contain a large proportion of iodine.

Forests of Alsace and Lorraine.—Rev. F. Moigno.—At the time when Jules Favre was engaged in treating for peace, his attention was called to the fact that the territory alluded to contains 133,500 hectares of forest land belonging to the State, and worth at least 300,000,000 francs, and that the giving up of this estate should be considered in the sum of indemnity to be paid by France. M. Jules Favre appears to have taken no notice of the hint given him. Prussia has therefore obtained this valuable property *pardessus le marche*.

Œnotannin.—M. Maurial.—After an experience of forty years, the author recommends this preparation to wine growers for keeping wines in good and sound condition without imparting to them a bitter taste.

Bibliography.—Under this heading, attention is called to the following pamphlet:—"Simples Indications pour Propager l'Emploi de l'Engrais-Vidanges dans les Diverses Contrées de France, et Note Relative aux Engrais Vidanges de Paris." Par Maxime Paulet. 8vo., 46 pp. Paris: Lacroix, éditeur. 1872.

Phosphoric Acid and Superphosphates Manufactory.—M. Blanchard.—An account is given of the method of preparing the sub-

stances alluded to as made at Puteaux, near Paris. In order to obtain phosphoric acid, the superphosphate (prepared from rich native phosphatic minerals) is mixed with water (1200 kilos. to 1000 kilos. of superphosphate), and this mixture put into stout linen bags and submitted to strong pressure by the aid of hydraulic presses. The liquid is collected in tanks, and next evaporated and concentrated; what remains in the bags is sold as superphosphate at 10 per cent. The lime is eliminated from the phosphoric acid-containing liquor by means of sulphuric acid, sulphate of lime being deposited by the concentration of the phosphoric acid solution.

Le Moniteur Scientifique Quesneville, No. 367, July, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral sciences:—

Study on the Quantitative Estimation of Phosphoric Acid in all Products of Agricultural Interest and those belonging to the Domain of Physiology.—Dr. Joulie.—The second instalment of a very complete monograph on this subject (see CHEMICAL NEWS, vol. xxv., p. 646). We regret that this excellent memoir is too long to be reproduced in full. There is added to this portion a letter from Dr. Bobierre, the celebrated agricultural chemist at Nantes, explaining his views on the memoir.

Analysis of Fossil Phosphates.—Dr. A. Bobierre.—This excellent essay, also too long for either reproduction or abstraction, winds up with the following general conclusions:—The only proper method of analysis of fossil phosphates is that whereby the phosphoric acid is separated. The commercial method of analysing bone-ash, bone-black, and similar products may be advantageously applied in many cases, provided care be taken to use pure ammonia, and also that the ammonia precipitate be not exposed too long a time to the air; this method should only be applied when agreeable to both seller and buyer.

The Eucalyptus Globulus considered from an Industrial, Hygienic, Economic, Medicinal, and Pharmaceutical Point of View.—F. Papillon.—This memoir treats at great length on a tree, native of Van Diemen's Land, or Tasmania, discovered there first on May 6th, 1792, by the French admiral, Labillardière, while in command of the *Entrecasteaux* and in search for *La Perouse*. From this essay, it appears that the cultivation of this tree, already acclimatised in Southern Europe and Algeria, may become of very great importance. The tree will not thrive in countries where the winters are rather cold. The tincture of Eucalyptus is stated to be an excellent remedy against ague and intermittent fever, especially that kind which is often endemic in marshy districts.

Improved Panification Process.—MM. Sauer and Cachal.—The authors have invented a liquid, to which the name "extract of yeast" is given, and which is so manufactured that, according to the different requirements of the baker, he can use a stronger or weaker fluid for the purpose of producing fermentation. The improvement upon the ordinary plan consists in a greater yield (from 16 to 20 per cent more) of bread, while also the production of alcohol and acetic acid (formed from the former) is prevented, and thus the gluten of the flour kept in a more sound state. The liquid alluded to is composed of some ten different ingredients.

Beet-Root Sugar Extraction.—M. Woestyn.—The description of an improved process of treating the beet-root juice, consisting mainly in precipitating, by means of a current of carbonic acid, the lime usually added in the first operation of treatment of the juice. The result is that, along with the precipitate of carbonate of lime, a great many impurities are thrown down.

Theory of the Mordanting with Alum of Woollen Goods.—P. Havrez.—This essay is divided into the following sections:—Active causes during the aluming; effects of dissociation and absorption; the alum-bath; effects of the two dissociated hydrates (viz., of alumina) upon wool—(*a*) in a quantity fifteen times larger than the weight of alum, (*b*) in by far smaller quantity; dilute sulphuric acid and wool; soluble hydrate of alumina and wool; conditions of duration (length of time), quantity, temperature, &c., which cause the increase of the dissociation and absorption of aluming; (*a*) action of the bulk of water; (*b*) action of the temperature; (*c*) action of the quantity of the wool; (*d*) action of the duration of the aluming. General conclusions:—Large quantities of mordants (salts of alumina, iron, chromium, tin, copper, &c.) act in solution as *salts* (or even as *salts* and *acids*) after having been absorbed by wool. Small doses of these mordants act upon wool as metallic hydrates, the formation of which is aided by prolonged boiling of the materials (viz., wool, water, and alum, or other salts, as the case may be). The unequal absorption by the wool of the dissociated basic hydrates and acids, and the reaction of these bodies, mutually cause these different actions; it thus appears that the excess of salt can be replaced by small quantities of acids or acid salts (of potassium, bisulphate, binoxalate, bitartrate, &c.), which become converted, in the water, into acid and neutral salt. The increase of metallic hydrate fixed is due to the addition of *water*, the application of heat, and the prolonged keeping of the wool in the bath. The colour which the wool assumes in the dyebeck reacts chiefly upon the first portions of acid hydrate and basic hydrate absorbed by the wool. The acid has a purifying action, and appears also to promote the liberation of the glucose colours (thus forming carmine-red from carmine), while the metallic hydrate fixes upon the wool the variously-coloured lakes.

Bulletin de la Société Chimique de Paris, Vol. xvii., No. 10, May 15, 1872.

This number contains the following original papers and memoirs:—

Action of Water and Heat, or of Heat only, upon Sugar.—E. J. Maumené.—200 grms. of sugar and 1000 grms. of water have been kept for some twenty-eight hours at the temperature of boiling water; the optical rotatory power of the sugar has then quite disappeared. Sugar and water have been enclosed in sealed tubes and kept for about thirty days at the temperature of boiling water, with the result that the sugar had become entirely converted into an uncrystallisabie compound, probably identical with that which Berzelius and Gelis have obtained by rapidly heating sugar to 160°. By heating sugar for eight days consecutively in sealed tubes in steam of 5 atmospheres pressure (75 lbs. to the square inch, and 153° C.), the sugar is converted chiefly into carameline, $C_{12}H_4O_4$. In conclusion, the author states that sugar, while being refined or extracted on the large scale, should never be submitted to a higher temperature than 75°, because below that degree of heat sugar is not perceptibly altered.

Action of Crystallised Digitaline upon the Combustion (Act of Respiration of the Lungs) and upon Diuresis.—A. Mégevand and G. Daremberg.—This paper, elucidated by a number of tabulated forms exhibiting the results of experiments, details the observations of the effects of the digitaline alluded to upon the authors, who partook of doses amounting to from one-fifth to one-half milligramme.

Vol. 17, No. 11, June 1, 1872.

Detection of Counterfeited Kirschwasser.—Dr. Bouis.—According to the author, tincture of guaiacum produces, in genuine Kirschwasser (a very strong alcoholic liquor prepared in some parts of Switzerland from a peculiar kind of cherries, which are bruised and crushed along with the stones, then fermented and distilled), a blue colour; but not so in the kirschwasser prepared simply by adding *aqua lauro-cerasi* to spirits. This blue colouration is, according to the author, due to traces of copper, which are found in the genuine spirit, and which gives a blue colour to the tincture in the presence of cyanhydric acid (always present in the genuine kirschwasser).

Memoir on a New Series of Platinic Compounds.—Dr. P. Schützenberger and M. Fontaine.—The first instalment of an extensive monograph, elucidated by a very large number of lengthy and complex formulæ, and divided into the following sections:—Introduction, containing an *expose* of the principal facts studied in this memoir; phospho-platinous chloride, $PhCl_3Pt=PhCl_3.PtCl_2$; phospho-platinic chloride, $(Ph_2Cl_6PtCl_2)$; phospho-platinous acid, $Ph(HO)_3PtCl_2$.

Oxidation of the Acetons of Phenyl-Acetic Acid.—M. Popoff.—This memoir, elucidated by a series of formulæ, treats on methyl-benzylic aceton and on ethyl-benzylic aceton.

NOTES AND QUERIES.

Amalgams.—During some recent experiments on amalgams, made with dry filings and mercury, with the object of obtaining one free from shrinkage, I find a law which apparently holds good in all cases, viz., that any alloy which when reduced to filings will harden, when mixed with mercury, without shrinkage, is also free from shrinkage when cast. An alloy containing gold, platinum, silver, and tin, if poured at a clear red-heat into a warm iron mould, remains perfectly rigid, and cannot be removed from the mould without considerable force. If this alloy, in filings, is mixed with about 15 to 17 per cent of mercury, and pressed into a solid mass into a mould, it remains tight in its place, without shrinkage, after it has become as hard as good brass, and continued heavy pressure will not force a trace of a coloured solution between the mould and the plug of amalgam. Whether this law holds good with every alloy I cannot say, but it evidently does so with a great many of similar composition to the one mentioned.—THOS. FLETCHER, F.C.S., 15, Bold Street Warrington.

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THE CHEMICAL NEWS.

VOL. XXV. No. 662.

ON THE

LAW OF EXTRAORDINARY REFRACTION IN ICELAND SPAR.*

By G. G. STOKES, M.A., Sec. R.S.

IT is now some years since I carried out, in the case of Iceland spar, the method of examination of the law of refraction which I described in my report on Double Refraction, published in the "Report of the British Association for the year 1862."† A prism, approximately right-angled isosceles, was cut in such a direction as to admit of scrutiny, across the two acute angles, in directions comprising respectively inclinations of 90° and 45° to the axis. The directions of the cut faces were referred by reflection to the cleavage planes, and thereby to the axis. The light observed was the bright D of a soda-flame.

The result obtained was, that Huyghens's construction gives the true law of double refraction within the limits of errors of observation. The error, if any, could hardly exceed a unit in the *fourth* place of decimals of the index, or reciprocal of the wave-velocity, the velocity in air being taken as unity. This result is sufficient *absolutely to disprove* the law resulting from the theory which makes double refraction depend on a difference of inertia in different directions.

I intend to present to the Royal Society a detailed account of the observations, but in the mean time the publication of this preliminary notice of the result obtained may possibly be useful to those engaged in the theory of double refraction.

ELECTROSCOPE PHENOMENON.

PROFESSOR FORSTER, in a recent number of *Poggendorff's Annalen*, gives an account of a curious effect observed in a gold leaf electroscope. He was one day showing to an audience, that if the leaves were in a state of divergence through negative electricity, the divergence would be increased on approach of a *negatively* electrified body, and that it would be diminished in the opposite case.

To prove this, he had a magnified image of the leaves projected on a screen. He rubbed a rod of caoutchouc with catskin, and touched with it the ball of the electroscope. On removing the rod, the leaves showed about 70° divergence. He again rubbed the rod, and brought it from above towards the electroscope, the axis of the former being at right angles to the vertical axis of the latter. Expecting the divergence to increase, he was surprised to find that it diminished, and on further approach became zero; while it increased on slightly removing the rod. If the rod was withdrawn very slowly, the divergence remained zero, but rose again to the former amount as the rod was further withdrawn. Frequent repetition of the experiment gave similar results; only, he remarks, the electrical source must be a pretty powerful one.

After various futile attempts to explain the matter, there arose the doubt whether the divergence which appears after making a rubbed caoutchouc rod touch the ball of the electroscope was really due to negative electricity (−E). He became convinced that, while the rod is, of course, negatively electrified, yet the leaves diverge with positive electricity (+E).

He thus describes his experiments:—"Let a caoutchouc rod be rubbed with catskin and brought near the knob of a Fechner electroscope" (in which, it may be explained, there is only one leaf suspended between the opposite poles of a pile). "The leaf then moves to the + pole. The rod is therefore − electrified. Now rub the rod again, and touch with it the knob of the gold leaf electroscope" (with two leaves). "Then remove the rod. Next, let the knob of this charged electroscope be brought near the knob of a Fechner electroscope (uncharged). The leaf of the latter moves to the − pole; the leaves of the former, therefore, diverged with + E; and thus the electroscope became +electrified through contact with the −electrified rod.

"It remained to ascertain the reason of this fact, which, once ascertained as a fact, removed the difficulty in the first experiment.

"When the strongly −electrified rod is brought near the knob, there takes place decomposition of the electricity in the electroscope. The + E flows into the knob, in which it is retained by the rod; the −E flows into the leaves, which diverge in consequence. While thus influenced by the rod, −E escapes, and there is a progressive collection and retention of +E in the knob. At the moment of contact between knob and rod, the rod communicates the −E, present at its point of contact, to the knob, and this neutralises in the latter a corresponding quantity of +E.

As, however, the excited parts of the rod not in immediate contact with the knob do not give up their −E, this surplus of −E still carries on the decomposition and retention of electricity in the electroscope; so that there comes to be much more retained +E in the knob than −E in the leaves (for a constant waste of −E takes place in the electroscope). If the rod is now slowly removed, its retentive influence on the knob decreases, and a certain quantity of +E flows into the leaves, neutralising there a certain quantity of −E. When the rod is just so far removed that as much +E can flow from the knob into the leaves as there is −E in these, the leaves become unelectrified and the divergence zero. On further withdrawal, still more of the hitherto retained +E flows from the knob to the leaves, and now commences a divergence with +E. When the rod is entirely removed, the whole of the hitherto retained +E is free and produces strong divergence. As the rod is approached again, these phenomena are witnessed in reverse order.

"This theory rests on the supposition that the +E which has been separated and retained by the rod preponderates over the −E communicated to the electroscope by contact (which is easily understood, as an electrified non-conductor gives up its electricity only at the point of contact). For this preponderance to take place, it is necessary, as has been said, that the electric source should be a very active one.

"It can, further, be easily shown that in such circumstances the −E flows away from the electroscope (without conduction) if the electrified rod be brought near the knob without touching it. In this case no electricity can flow directly from the rod to the knob, and yet, if after a few seconds the rod be withdrawn, the leaves diverge considerably with +E. The explanation is simple.

"The fact, however, that it is possible, by contact of the electroscope with a negatively electrified body, to obtain +divergence, appears to me one of considerable importance.

"Thus, supposing, in the absence of a pile electroscope, it were required to determine whether a body rubbed with a certain kind of material became + or − electrified, it would be a very likely method to first cause divergence in the electroscope leaves with a rubbed caoutchouc rod, and then test the electric state of the body in question by its influence on the divergent leaves, and call it + or − accordingly. On the former supposition, that the leaves diverged with electricity of the same sign as the caoutchouc rod, any such judgment would be absolutely false, A + electrified body would be taken for a −, and *vice versa*.

* A Paper read before the Royal Society.
See p. 272.

"Such error might be guarded against if, instead of bringing the caoutchouc rod near the electroscope, a small charge of −E were brought from the former, by means of a proof plane, to the knob of the latter, as the proof plane would not collect sufficient electricity to produce the disturbance observed in the other case."

A. B. M.

ON A NEW SULPHATE OF COPPER VOLTAIC ELEMENT,

ARRANGED WITH THE VIEW OF THE

APPLICATION OF CONTINUOUS CURRENTS TO THERAPEUTIC PURPOSES.

By M. J. MORIN,

This new element has for its object the complete avoidance of the inconvenience which results, in the ordinary sulphate of copper element, from the deposit of zinc either on the copper or the porous cell. It consists of a cylinder of copper, the interior of which is concentric with the cylinder of zinc; the annular space comprised between these two metallic surfaces is divided into two equal parts by a cylinder of filter-paper. Ordinary sandstone is put between the interior surface of the copper and the paper diaphragm, and sublimed sulphur on the side of the zinc; the whole is plunged in a solution of sulphate of copper, which penetrates through the mass by means of the numerous minute orifices freely to the copper.

Some hundred elements prepared in this manner, and frequently in use, have been set up for more than twenty months, and the alteration which they have undergone shows that this is but half the time for which they may be worked; they have been perfectly closed during this time, and have neither been subjected to repair or inspection.—*Comptes Rendus.*

ON THE ESTIMATION OF CITRIC ACID, FREE AND COMBINED,

AND ON A

NEW SERIES OF COMPOUND CITRATES.

By J. CREUSE, of Brooklyn, N.Y.

Having undertaken the study of the citrates as a class, and especially of those of the citrates in which the acid is combined with more than one base, the first difficulty I met was how to determine citric acid without having recourse to the long and complicated process of an organic elementary analysis. I consulted the most recent publications and some eminent chemists without obtaining my desideratum, viz., how to determine citric acid, free and combined, in the same direct manner as sulphuric or muriatic acid. Then the only thing left for me was to try myself and find such a process, in which I succeeded, after many failures, including an explosion of citrate of silver.

As this process may be interesting and useful, I will describe it here.

It is founded on the fact, that, while the alkaline citrates, the alkaline acetates, and the acetate of baryta are freely soluble in alcohol, sp. gr. 0·908 (63° Gay-Lussac), citrate of baryta is completely insoluble in that menstruum, and, when the reagents are neutral, is always precipitated by double decomposition in the shape of the neutral citrate, $3BaO,C_{12}H_5O_{11}$, with a variable equivalent of water.

As the presence of alkaline or barium acetates does not interfere with the reaction, this enables the chemist to determine citric acid in almost any shape; for free citric acid may be saturated with an alkali, alkaline citrates may be analysed directly, and other citrates may be decomposed by an excess of caustic potassa, the excess of alkali being neutralised by acetic acid.

This method, presenting some peculiar features, requires to be explained in full.

If the citric acid to be estimated is in the shape of an alkaline citrate, take from 1 to 2 grms. of the salt and dissolve in 10 to 20 c.c. of distilled water; neutralise the solution with acetic acid if it is alkaline, with ammonia if acid; then add a slight excess of a neutral solution of acetate of baryta and twice the volume of the whole liquid of alcohol 95 per cent; allow to rest for from 12 to 24 hours. The citrate of baryta, which was at first in the shape of a thick jelly, will have become, by that time, denser and easier to wash. Transfer the whole to a suitable filter; as some of the citrate of baryta always adheres to the sides of the vessel where the precipitation has been effected, it is recovered thus:—Pour into the vessel 10 to 15 c.c. distilled water, turn it around so as to wet all the places where any of the salt is left adhering; citrate of baryta, being to a certain extent soluble in water, is soon taken up by the liquid; then add to it double its volume of alcohol 95 per cent, and pour on the filter with the first product. This being repeated a second time, all the citrate of baryta may be considered as collected on the filter. Wash this thoroughly with alcohol 63 per cent, and dry at a moderate heat. The precipitate thus obtained contains *all* the citric acid of the citrate in the form of citrate of baryta; but this salt is too hygroscopic to give correct results if weighed directly. It is necessary to transform it into sulphate of baryta. This is done without difficulty, by burning the filter and heating the ashes and precipitate with sulphuric acid several times, till a constant weight is obtained. The weight of the sulphate of baryta is then noted, and from this the weight of the citric acid may be calculated within 2 or 3 milligrammes.

If free citric acid is to be estimated, a convenient quantity may be first saturated with a titrated solution of caustic soda, which gives usually a little more than the actual strength; the citrate of soda may be then treated in the manner described above, which gives a result a little below the truth, and the average between the two results will be within 1 or 2 milligrammes of the truth.

If it is proposed to estimate the citric acid of a citrate of bases other than the alkalies, soluble or otherwise, the operation is to be conducted in this manner:—

A certain quantity of the salt, from 1·50 to 2·50 grms., is heated carefully with a solution of caustic soda or potassa in excess; the heat must be applied long enough to precipitate the base thoroughly, but not enough to alter the citric acid into aconitic, oxalic, or any other derivative; the liquid is then filtered as usual, and exactly saturated with acetic acid; after which it is treated as an ordinary alkaline citrate. For obvious reasons the saturation must be as perfect as possible.

The solution of acetate of baryta used for these precipitations may be prepared by saturating pure acetic acid diluted, with an excess of carbonate of baryta, heated to ebullition, adding some alcohol when cold, and filtering. This solution may be titered so as to contain a certain percentage of baryta, say 5 per cent, in order to facilitate its use. The addition of alcohol insures its keeping unchanged for an unlimited period.

I am aware that none of these methods can be applied to the estimation of citric acid in those citrates the base of which is soluble in alkalies. These require a peculiar modification, of which I intend to treat another time.

As illustrations, I will describe a few analyses performed by my method.

Estimation of Free Citric Acid.

A certain quantity of crystallised citric acid containing 4 equivalents of water, unknown to me, was weighed at

my request by a friend, and dissolved in 10 c.c. of distilled water. A titrated solution of caustic soda, added till saturation, indicated 0·877 of citric acid. The neutral citrate of soda thus obtained was treated in the manner above mentioned by acetate of baryta; the citrate of baryta was transformed into sulphate, and this salt repeatedly ignited was ascertained to weigh 1·518 grms.

To calculate from this the weight of citric acid we establish the proportion—

$$201 : 349{\cdot}5 = 1{\cdot}518 : x$$
$$\text{or } \log. x = \log. 201 + \log. 1{\cdot}518 - \log. 349{\cdot}5$$
$$x = 0{\cdot}873$$

The average between the two valuations would be 0·875. The actual weight of the citric acid had been 0·875 grms.

Analysis of Citrate of Bismuth.

This citrate of bismuth is the salt obtained by precipitating acid nitrate of bismuth by a neutral alkaline citrate. It is insoluble in water, and may be obtained pure without difficulty.

Two grms. of this salt were taken, suspended in water, and decomposed by an excess of caustic potassa at a moderate heat, slowly increased till the boiling-point was reached. The precipitate of anhydrous teroxide of bismuth, well washed and dried, was found to weigh 1·122 grms. The washings were collected together, saturated with acetic acid, treated by acetate of baryta and alcohol, as already mentioned, and the citrate of baryta, thus separated, yielded 1·674 grms. of sulphate, which corresponds to 0·790 of citric acid. The balance 0·09 represents the equivalents of water and the loss, Hence we may figure the result thus:—

Teroxide of bismuth ..	1·122	1 equivalent.
Citric acid	0·790	1 ,,
Water	0·086	2 ,,
Loss	0·002	
	2·000	

Or in other figures—

Teroxide of bismuth ..	232
Citric acid	165
Water	18
	415

From this, I think the formula of the insoluble citrate of bismuth may be safely said to be—

$$BiO_3,C_{12}H_5O_{11}+2HO=415.$$

Double Citrate of Bismuth and Ammonia.

This combination is obtained in two forms—in solution and in scales. In solution it may be either acid, alkaline, or neutral; in scales it is always acid, on account of the loss of some ammonia during evaporation. It is very extensively used in medicine; unfortunately its solution is rather unstable.

The analysis of this salt presented no difficulty: 2·085 grms. of the insoluble citrate of bismuth were weighed in a small porcelain dish, a little warm water added, and a small piece of litmus-paper allowed to float on it. Then a titrated solution of ammonia, containing 0·26 grm. of ammonia to the 100 measures, was cautiously added, the mixture being stirred all the time. As the last drops of the 100 measures fell into the porcelain dish, the litmus-paper, red until then, turned blue, and at the same time the liquid became perfectly clear. Thus by synthesis this gives for the neutral citrate of bismuth and ammonia the following formula:—$2NH_3,BiO_3,C_{12}H_5O_{11}+nHO$. That is, two equivalents of ammonia, and one of bismuth teroxide saturating one equivalent of citric acid, the proportion of water being undetermined.

The analysis of the salt in scales was effected thus:—2·302 grms. of the ammonio-citrate of bismuth in scales (as it is commonly called) were dissolved in a little warm water, and a small piece of blue litmus-paper was made to float on it. The litmus-paper turned red immediately. Then, the same titrated solution of ammonia already mentioned was added carefully till saturation. Of this, 25 measures were necessary, corresponding to ½ equivalent. This demonstrated already that the quantity of ammonia contained in the salt was 1½ equivalents.

The liquid was then decomposed by caustic potassa in excess, and the operation conducted precisely in the manner described for the analysis of citrate of bismuth. The following numbers were obtained:—

Teroxide of bismuth	1·170
Citric acid	0·823

The quantity of ammonia being already known, the compound may be re-constructed thus:—

Teroxide of bismuth ..	1·170	1 equivalent.
Citric acid	0·823	1 ,,
Ammonia	0·122	1½ ,,
Water	0·180	4 ,,
Loss	0·007	
	2·302	

Or, in chemical symbols—

$$1\tfrac{1}{2}(NH_3),BiO_3,C_{12}H_5O_{11}+4HO=458{\cdot}5.$$

I must say that in this salt I believe the proportion of ammonia may vary slightly, according to the mode of evaporation; it cannot fall below 1½ equivalents, however, without causing a decomposition of the salt.

Analysis of the Double Citrates of Bismuth and Potassa, Soda, and Lithia.

I believe these combinations have neither been mentioned nor obtained yet by any body. Besides their interest in a chemical point of view, I think they will become of some importance in medicine, on account of their greater stability compared to the analogous ammonia salt. Of this I will treat another time.

The potassic and sodic citrates of bismuth are obtained easily by adding 2 equivalents of the caustic alkalies to 1 equivalent of the simple citrate of bismuth suspended in water, moderate heat being applied. They require, however, a little more care than the corresponding ammoniacal combination; for any excess of soda or potassa is liable to precipitate some of the metallic oxide, a decomposition which ammonia will not cause under any circumstances.

The double citrate of bismuth and lithia is prepared by adding 2 equivalents of carbonate of lithia to 1 equivalent of the simple citrate of bismuth, heat also being applied.

The following are the formulæ of these double citrates:—

$$2KO,\ BiO_3.C_{12}H_5O_{11}+nHO,$$
$$2NaO,BiO_3.C_{12}H_5O_{11}+nHO,$$
$$2LiO,\ BiO_3.C_{12}H_5O_{11}+nHO.$$

Not having obtained yet any of these salts in scales, I cannot state the equivalent of HO.

I have remarked, also, that the 2 equivalents of alkali necessary to form the neutral citrate need not be of the same base; thus 1 equivalent of soda and 1 of lithia form a neutral soluble citrate with 1 equivalent of citrate of bismuth, &c.

All these double citrates are soluble and uncrystallisable.

My study of the citrates is very far from being completed; but I have collected facts enough to justify me in proposing to divide the different citrates into three classes.

In the *first class* I would place all the various simple citrates, where the acid is combined with 1, 2, or 3 equivalents of one base. These are so well known that little need be said about them.

The *second class* would comprehend the double citrates, that is, those salts in which 1 equivalent of citric acid is

combined with 2 equivalents of an alkali and 1 equivalent of another base, generally metallic. The simple citrate of this base is in most cases insoluble or little soluble in water, while the double citrate is soluble in all proportions. The various double citrates of bismuth mentioned in this paper may be considered as types of this class. This class of salts is very large; a great many are known and mentioned, such as ammonio-citrate of bismuth, ammonio-citrate of iron, potassic-citrate of magnesia, zinc, &c. The composition of none of them, however, is stated anywhere to my knowledge.

The *third class*, or quadruple citrates as I propose to call them, is not so well known, the only one being, I believe, the soluble pyrophosphate of iron discovered in 1856 by E. Robiquet, my late friend and employer. I consider these salts as a combination in which an alkaline neutral citrate plays the part of a base, and a peculiar metallic salt the part of an acid. I have already collected several facts in support of this theory, but they require proper elucidation and study to prove it conclusively. I will only mention that, in following up this theory, I have already discovered the following new combinations, which I place in the third class:—

Phosphate of sesquioxide of iron,		
Hypophosphate	,,	,,
Valerianate	,,	,,
Arseniate	,,	,,

in combination with the neutral citrates of potassa, soda, lithia, and ammonia.

All these salts are uncrystallisable, soluble in water in all proportions, little so in alcohol; they have no taste of iron; all are decomposed by direct sunlight, and all have a greenish colour, varying from bright apple-green to dark olive-green. The valerianate of iron, possessing by itself a bright red colour, forms, with citrate of ammonia, a combination of an extremely bright green colour.

I have obtained all these salts in solution, and some of them in scales. The solutions keep very well for a long time if about 16 per cent of alcohol be added and direct sunlight excluded: they may be preserved, also, by the addition of enough sugar to give them the strength of officinal syrup (a little less than twice their weight).

I have not analysed any of them yet, but will publish the results of their analysis as soon as satisfactorily obtained.—*American Chemist.*

ON THE

EVIL EFFECTS OF THE USE OF ARSENIC IN CERTAIN GREEN COLOURS.*

By FRANK W. DRAPER, M.D.

(Continued from p. 41).

V. *Paper-Hangings.*—Important as are the topics which have thus far engaged our attention in the study of the arsenical greens and of the possible dangers incident to their use, they appear to have always been considered as of less significance than those relating to arsenical paper-hangings. Since Professor Gmelin, of Heidelberg, called attention, in 1843, to what he deemed the deleterious effects of living in rooms whose walls were decorated with green paper, the subject has been repeatedly investigated in all its relations. Distinguished scientific authorities in Germany, France, England, and America have regarded the matter as one eminently deserving careful consideration, and the unanimity which characterises the results of their studies can leave little room for doubt in unprejudiced minds concerning the harm which may ensue, under certain conditions, from the use of arseniferous wall-paper. Other observers, comparatively few in number, who have arrived at negative or at wholly dissenting conclusions, seem to have based their experiments on wrong premises, or to have shown partiality in their statements.

As a result of the unequivocal warnings published by physicians in past years, the use of the arsenical paper-hangings became for a time and in some degree unfashionable. But the dictates of fashion are capricious, and are not long mindful of the protests of science. The public has forgotten the experiences of ten years ago, and the poisonous paper-hangings are displayed in the shops to-day with the same fascinations of colour, design, and finish that has characterised them in the past. In every store which the writer has visited in the course of these investigations, specimens of the paper have been obtained which, on being tested, exhibited the presence of the arsenical pigment in a greater or less degree.

This renewal of a practice which has been condemned heretofore in terms of unconditional disfavour justifies a renewed investigation of the subject. It is a matter of no ordinary importance to a community to know that, by the use of paper-hangings of a certain colour, the health of individuals is seriously jeopardised. It is not a pleasant thing to realise that the very means we take to make our homes more cheerful may become the direct source of impaired health, and that the beautifully artistic designs which decorate the rooms in which we live or sleep may be the subtle agencies whereby the sum of human misery is increased.

It ought to be remembered, at the outset of this inquiry, that all paper-hangings which are green are not to be condemned as poisonous. Not a small proportion owe their tint to other pigments than the arsenite of copper. And this fact that the arsenical papers are found in comparatively good company adds another element of importance to the subject, suggesting the greater need of discrimination. Moreover, with regard to paper-hangings which are actually arsenical, it will be perhaps exceptional to find specimens coloured to any great extent with the unadulterated arsenite or aceto-arsenite of copper, as distinguished by the purity and brilliancy of the green tint, because it is the custom of the manufacturers to modify the shade of green by the addition of substances which shall make the tint darker or lighter to suit varying tastes; yet the primary pigment contains arsenic, whose presence can be detected only by the chemist's test, and not by any distinctive physical appearance. To proscribe a wall-paper, therefore, because it is green, and without further test to condemn it, even though it be found on the room of a confirmed invalid, would be hasty judgment, while, on the other hand, cases undoubtedly occur in which obscure and distressing symptoms are due to arsenical poisoning, the agent being concealed in a tint bearing so distant a resemblance to the brilliancy of pure emerald green as to readily escape detection.

In the manufacture of paper-hangings, no provision is made with a special view of anticipating and preventing any possible harm which may result from the employment of the arsenical pigment. Whether the pattern be a plain or a figured one, the colouring matter is made to adhere to the paper by means of size. The emerald green, generally adulterated with Paris white or some other neutral agent in order to obtain the desired shade, is mixed with warm water in which size has been dissolved; in this process of colour-mixing the workman often uses his hands, plunging the fore-arm nearly up to the elbow into the sieve through which the ingredients are passed. When the colour is prepared, it is applied to the surface of the paper by means of a series of brushes worked by machinery, and a uniform coating is thus quickly secured. Passing from this machine, the paper is suspended in long loops from sticks which rest on a slowly moving, endless chain arranged near the ceiling; being carried thus in loops the length of a long room whose temperature is maintained at a high degree by steam apparatus, the paper becomes thoroughly dried. If it is to be "satined," or glazed, it is passed through a series of dry brushes which revolve with great rapidity. The figured patterns are printed by

* From the "Third Annual Report of the State Board of Health of Massachusetts."

two methods. The slower, but more accurate process, and therefore better adapted for fine work, is by hand-printing, the pattern being secured by blocks, a colour at a time, precisely as in the earliest days of paper-hangings. But most of the printing is done by machinery not unlike that used in calico printing. The paper is passed against a series of revolving wooden cylinders, on whose surface are raised figures corresponding respectively with the individual shades of colour to be observed on the paper when finished; each cylinder is fed with its own pigment by means of a revolving belt of fine woollen, which passes through a trough of colour. The variety called "flock-paper" requires a special process to give it the well-known roughened or velvety aspect. The flock consists of the finely-divided shreds of waste woollen cloth. The stock is scoured and dyed. It is then stove-dried and ground to a fine powder; the requisite degree of fineness is secured by successive sifting in a bolting apparatus. A quantity of this woollen dust is enclosed in a large chest or drum, the bottom of which consists of sheep-skin or of strong cloth. The paper is first prepared with a layer of size and then of varnish. If the paper is to be a plain flock, this adhesive material is spread uniformly; if figures are desired, the pattern only is printed in varnish. Successive portions of the paper are passed into the drum, and, the bottom of the chest being beaten, the flock dust is raised to settle on the still moistened and adhesive surface, where it is allowed to dry.

From this description it will be seen that the arsenical paper-hangings include three well-defined varieties, according to the methods used to attach the colouring matter to the surface of the paper with greater or less degree of permanency; they are unglazed, or satined, or flock. These comprise all grades, from the most costly to the cheapest, and vary from the plainest surface to the most elaborately figured designs. In some there is a thick coating of the colour, loosely applied, either for a perfectly undecorated paper or to serve as a ground on which to impress the various figures. In others, only isolated or small patterns of foliage contain the green pigment. Of all the varieties, however, those which have an unglazed surface are the most likely to produce harm, since in this class the colour is only moderately adherent, and is removed by the slightest friction. The glazed papers are less open to this objection, because the process which gives the polish serves also to fix the pigment more securely. From such a surface the green dust would not escape readily, until, after long wear or by frequent dusting abrasions in the glazing were produced. The flock papers occupy an intermediate place between the two varieties alluded to. The wool which constitutes the flock is generally of a dark green colour from vegetable dyes; and if the arsenical pigment is used, it is found in the ground tint on which the flock is laid, or in the green-figured foliage formed in the intervals. The flock, as primarily prepared, is not poisonous; but it may become so, since it is easily detached from the paper, and may bear away with it particles of the subjacent colour.

The quantity of the poisonous colour which is used upon these papers varies exceedingly, of course, but occasionally it is found in very large amount. Professor Bacon asserts: "Frequently so much as 50 or 60 grains of the arsenical pigment is spread on each square foot of the paper."* In a specimen examined by Dr. Halley, nearly a drachm of the colour was found in the square foot;† and Dr. Taylor states the results of his analyses to vary from 28 to 70 grains in the same surface.‡ Two samples of the paper are exhibited; they have been analysed for the writer by Mr. Pearson at the Institute of Technology. The lighter-coloured specimen contains 5·42 grains of arsenic in each square foot. The paper also shows under what a deceptive guise the arsenical pigment may appear. The second sample, which is typically arsenical, and which represents the colour in its purity, has 29·32 grains of pure arsenic in each square foot. Taking the average of these results, a room of ordinary dimensions, decorated with arsenical paper-hangings, would hold on its walls considerably more than a pound of a poisonous colouring matter containing half its weight of arsenic.

The question, however, which most concerns us is, Does the presence of this pigment, in such large amount, on the walls of rooms habitually occupied by day or night exert any deleterious influence on the health of the occupants? Can an agent, avowedly very poisonous when swallowed, become disengaged in any way, directly or indirectly, from the surface to which it is but loosely attached, and contaminate the atmosphere to such a degree as to produce, by slow but continuous absorption, unmistakeable symptoms of injury? There will be those who, through incredulity or from motives of interest, will cite cases of perfect immunity under such conditions, and will maintain that the brilliant colour is inert, even granting the presence of arsenic, and that there is nothing in the paper-hangings in question to arouse alarm or suspicion. The alleged cases of illness from this cause ought rather, they say, to be attributed to bad ventilation and other abuses. Nevertheless, when the many recorded and well authenticated instances of impaired health, including a considerable number which have terminated fatally, are examined impartially, little room is left for scepticism. The cases are too numerous and too unequivocal to be thrown aside, and constitute a mass of evidence which cannot well be refuted. It will be unnecessary to cite a great number of these cases here. The columns of the medical and of the general press of the last ten years contain the histories of numerous instances; and of these only a few of the typical ones will be quoted as illustrations.

Dr. Halley, of London, has reported a case of arsenical poisoning in which he was himself the victim. His library walls had been covered with a newly-made, rich, emerald-green flock-paper. Shortly after the work was finished, he commenced to occupy the room every evening for some five or six hours, a single gas-burner supplying the light. After a few days he began to suffer considerably in health; there was constant headache, dryness of the throat and tongue, with internal irritation. After three weeks of this experience, he became completely prostrate, not yet, however, suspecting the cause of his malady. Partial paralysis of the left side supervened. His condition obliged him to discontinue his studies in his library, and coincident with this intermission he began at once to recover. But as soon as he re-commenced his labours the symptoms recurred. His attention was now called to the paper on the walls of the apartment. It was found to contain nearly 60 grains of Scheele's green to the square foot. The air of the room was likewise tested, and distinct crystals of arsenic were obtained from the dust. The paper was at once removed, and there was no further trouble.*

In 1862, a case of fatal poisoning under the conditions in question occurred in the suburbs of London, the victim being a child. The cause of death was made the subject of an investigation before a coroner's jury. In the course of the evidence, it transpired that the deceased was the last of four children who had died within a period of two months under exposure to the poison contained in the paper-hangings of the room they habitually occupied. They had all been attacked in the same manner, the prominent symptoms being referred to the throat. The colour was loosely applied, having no glazing. It was very deliquescent; at 50° it was quite damp, and the stain came off on the hand like paint. Three grains of arsenic were found in a square foot of the paper. The symptoms were attributed by the surgeon in attendance, Mr. Orton, and by Dr. Letheby, who made the *post mortem* chemical examination, to arsenical poisoning.†

* *Boston Med. and Surg. Journ.*, vol. lxix., p. 490.
† *Medical Times and Gazette*, Jan. 16, 1868.
‡ Taylor, "On Poisons," p. 434.

* *Med. Times and Gazette*, Jan. 16, 1858.
† *Med. Times and Gazette*, May 3, 1862.

In a case reported by Dr. Guy, the patient being a young lady, there were observed gastric irritation, emaciation, flatulence, pain in the abdomen, loss of appetite, nausea, a furred tongue, dryness of the mouth and throat, a quick, small pulse, oppressed respiration with dry cough, failure of strength, an aversion to food and drink, a blanched complexion. Temporary absence from home brought relief to the sufferer, but it was not until after recurrences of the symptoms coincident with the return to the arsenical room that the wall-paper was suspected. The paper was removed, and a plain white paper took its place, and no further symptoms of poisoning were experienced. The workman who removed the arsenical paper was very ill the whole night and day following, "with cramps, sickness, and pain." The green paper was a glazed, watered pattern, covered with two shades of the most delicate tint.*

Dr. Hinds reports an experience not unlike that of Dr. Halley. He says:—

"In 1849 I ordered my study to be re-papered, and I selected for this purpose a neat paper, with only about two shades of green, of a bright and elegant tint. In a day or two after the room was papered I began to use it. I had a fair gas-light, and towards evening I began to read. When about an hour and a half to two hours had passed, symptoms of severe depression seized me, soon followed by a feeling of nausea and an inclination to vomit. There were occasional pains in the abdomen also, and the prostration was presently accompanied with a feeling of faintness which suspended my operations. The very same thing occurred every successive evening, when the door of the room was closed, the gas-light burning, and after I had remained about a couple of hours in the room. The unpleasant symptoms gradually subsided when I had left the room, a feeling of faintness and some stomachic derangement alone remaining."

The green pigment, on being sublimed in a test-tube, gave abundant crystals of arsenious acid. The paper was removed, and the annoyance never reappeared.†

Dr. Hinds also reports other cases under his personal observation. In one of these, a gentleman of Birmingham had two parlours papered with a bright green paper. In less than a week afterwards, both himself and his wife, previously in good health, became ill. They were in the habit of sitting in one of the rooms regularly. The symptoms complained of were great prostration of strength, headache, and a low, febrile condition, together with inflammation of the eyes (*conjunctivitis*), thirst, loss of appetite, heat and dryness of the throat, with tightness across the forehead. The great inaptitude for exertion and general prostration of the strength appeared prominent. As in the previous cases, temporary absence from home was attended with a remission of the symptoms, and the removal of the paper was followed by early and complete restoration of health. The paper was of the "flock" variety, with a profuse pattern of a light and elegant green on a flock ground, yielding, on analysis, an abundance of arsenic.‡

Dr. James Whitehead, of Manchester, has recorded an instance, which may be cited as a typical one, not only as illustrating the disease in question, but as affording an example of the difficulties sometimes experienced in determining its true character. The patient, a young man, suffered from ulceration of the gums and tonsils, violent frontal headache, great languor, nausea and occasional vomiting, inappetence for exertion, and disturbed sleep. The complaint, mild at its onset, gradually increased in severity in spite of medical treatment, and at the end of eight or ten weeks the patient was removed to the country; here he was speedily restored to health. On his return home, perfectly well, he was placed in the same room he occupied before; in the space of four weeks he was worse than ever. The drains being suspected of some indirect influence in causing the diseased condition, they were examined, but nothing was discovered to account for the trouble. Attention was next directed to a cistern which adjoined the wall outside the patient's room, and it was re-modelled with the hope of remedying the mischief. The repairs necessary for this change required the patient to occupy another room for a fortnight; this intermission was attended with considerable relief, and he returned to his old apartment feeling much better. The former symptoms recurred with aggravated severity, and now for the first time it was suspected that the wall-paper was the source of the mischief. The paper was replaced without loss of time by one of a totally different shade, and results in every way satisfactory followed. There was no relapse of the symptoms after the removal of the paper, and the young man occupied the room without further annoyance.

The paper was a "rich green flock paper." While it was being applied, a green dust escaped freely; and afterwards, whenever the walls were cleaned, a similar powder was found on the furniture. 30 grains of the pigment yielded, on chemical analysis, 11 grains of arsenic, and it was estimated from this that the room, having a superfices of 350 square feet, held in its paper-hangings, after four years of usage, 3,850 grains, or about half a pound, of white arsenic.*

(To be continued.)

* "Fifth Report Medical Officer Privy Council," p. 137.
† *Med. Times and Gazette*, May, 1857.
‡ *Med. Times and Gazette*, May, 1857.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.†

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 41).

Carmine Lakes.—These very beautiful pigments are prepared from a decoction of cochineal, and not from carminic acid, the animal matter which the insect contains, appearing to be necessary to their production. The mode of preparing the finest qualities is kept a secret by the manufacturers; but I will describe two processes which give very satisfactory results. The first consists in boiling one pound of ground cochineal with two gallons of water, to which has been added one ounce of alum. It is then boiled for three minutes, the liquor is allowed to settle, and, after having been kept for several days, about an ounce of a bright carmine lake is produced. For the alum employed in this process cream of tartar can be substituted. The second process consists in boiling for three hours two pounds of powdered cochineal in thirty gallons of water. To this is added three ounces of pure saltpetre. The liquor is then boiled again and left to settle. The clear liquor is run off, and after two or three weeks yields a fine carmine lake.

As these lakes are expensive, they are often adulterated with starch, kaolin, vermillion, &c. The complete solubility of pure carmine lakes in ammonia affords a ready means of detecting these adulterations.

Kermes.—This colouring-matter is also derived from a variety of *Coccinus*, which lives on the species of oak called *Quercus coccifera*. The young female animal fixes itself under the epidermis of the leaves or young shoots of the oak, in the early part of spring. As the insect grows, it gradually swells out the epidermis, covering the surface of the leaves or branches with a multitude of excrescences. During this period it deposits its eggs.

In Spain and the South of France, during the month of June, or just before the eggs produced would be hatched, the animals are removed, and destroyed by placing them in the steam from heated vinegar.

Although this colouring-matter is seldom used in England, it is extensively employed in the South of France, in Spain, Morocco, and Turkey, to dye morocco

* *British and For. Med. Chir. Rev.*, vol. xxiii., p. 519.
† The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

leather, and to dye woollen cloth with that particular shade which characterises the cap called "fez," worn by the Asiatics.

If the colour is not so brilliant as that of cochineal, it has the advantage of not being changed by soap or dilute alkalies. It is also employed at Milan, Rome, and Florence to colour a very favourite beverage known as alkermes. The colour-giving principle of this insect is identical with that of cochineal, and has been used as a dye in the East from time immemorial.

Gum-lac.—This is another variety of the *Coccinus*, which lives especially on the *Ficus*, or fig tree. They reproduce themselves with such rapidity and in such numbers that they entirely cover the surface of the branches of the trees on which they are deposited. Owing to a resinous fluid which they secrete, they form solid masses, which are often a quarter of an inch thick, all round the branches, and adhere very firmly to them. The natives break of these branches just before the hatching season of the animal, and expose them to the sun to kill the insect. These gum-lac twigs are sold under the name of stick-lac. Those of Siam are considered the best, those of Assam next, and those from Bengal the worst.

There are three kinds of lac in commerce—stick-lac, which has just been described, seed-lac, and shell-lac. The resinous concretion is taken from the twigs, coarsely powdered, and triturated with water in a mortar. The greater part of the colouring principle is thus dissolved.

The granular portion which remains is dried in the sun, and constitutes seed-lac. Shell-lac is obtained by melting seed-lac, and straining whilst hot. It is then dropped upon smooth stems of the banyan tree, and so runs into thin plates, which are known in commerce under the name of shell-lac.

These three lacs have the following composition :—

	Stic-lac.	Seed-lac.	Shell-lac.
Resin	68·0	88·5	90·9
Colouring matter ..	10·0	2·5	0·5
Wax	6·0	4·5	4·0
Gluten	5·5	2·0	2·8
Foreign matters ..	6·5	—	—
Loss	4·0	2·5	1·8
	100·0	100·0	100·0

The colouring matter of the insect is identical with that of cochineal and kermes, and it has been employed as a scarlet dye-stuff in the East from time immemorable.

Lac-lake and Lac-dye are preparations imported into this country from India since 1796. They are both prepared by acting on stick-lac by a weak alkaline solution, to which is then added a solution of alum. This produces a precipitate, which, when washed and dried, is ready for use. Although both these lakes are prepared with the same substances, lac-dye is considered much superior in quality. This is due to the greater care bestowed on its preparation. The details of the process are kept secret.

To dye woollen cloths with them, they are dissolved in a weak solution of vitriol, to which is added a little oxymuriate of tin, and the cloth dipped in when the liquid is near the boil. It only requires washing and finishing to be ready for market.

Some years ago Messrs. E. Brooke and Co., of Manchester, introduced a lac-dye much superior to that imported from India, which they prepare by treating stick-lac with weak ammonia, and adding chloride of tin to this solution, when a fine red precipitate is formed, which, collected, is ready for use.

Murexide or Roman Purple.—Although this colour has now been superseded by those derived from coal-tar, I call your attention to it as an example of the assistance rendered by the progress of chemistry to the art of calico-printing.

In 1776, the illustrious Swedish chemist, Scheele, discovered *uric acid* in human urine. In 1817, Brugnatelli found that nitric acid transformed uric acid into a substance which he called *erythric acid*, but which was afterwards named by Wöhler and Liebig *alloxan*. In 1818, Dr. Prout found that this latter substance gave, when in contact with ammonia, a beautiful purple-red colour, which he named *purpurate of ammonia*—the product known by the name of *murexide* since the researches of Liebig and Wöhler in 1857. These discoveries remained dormant in the field of pure science until the year 1851, when Dr. Saac observed that when alloxan came in contact with the hand it tinged it red. From this he inferred that it might be employed to dye woollen fabrics red, and further experiments showed that if woollen cloth, prepared with a salt of tin, were passed through a solution of alloxan, and then submitted to a gentle heat, a most beautiful and delicate pink colour was obtained.

In 1856, MM. Depouilly, Lauth, Meister, Petersen, and A. Schlumberger applied it as a dying material to silk and wool, and succeeded in producing red and purple colours, by mixing the murexide with corrosive sublimate, acetate of soda, and acetic acid.

For printing upon cotton, a mixture of murexide with nitrate of lead or acetate of zinc, properly thickened, was printed on the fabric, which was then allowed to dry for a day or two, when the colour was fixed by passing them through a mixture of corrosive sublimate, acetate of soda, and acetic acid.

The uric acid required for the preparation of such large quantities of murexide was obtained from Peruvian guano. The guano was treated with hydrochloric acid, and washed. The insoluble mass was then treated with nitric acid of specific gravity 1·40. When the action of the acid was completed the mass was treated with warm water to dissolve out the alloxan. It was then carefully evaporated to such a degree that it became solid on cooling. The solid mass had a brown or violet colour.

(To be continued.)

NOTICES OF BOOKS.

Air and Rain: The Beginnings of a Chemical Climatology. By ROBERT ANGUS SMITH, Ph.D., F.R.S., F.C.S., (General) Inspector of Alkali Works for the Government. London: Longmans and Co. 1872.

DALTON, the father of meteorology as well as of strictly scientific chemistry, declared in the later years of his life that chemical experiment could not distinguish the air of Manchester from the air on Helvellyn. Presently we shall see what progress has been made in chemical determination. Dr. Smith very modestly terms his work the "Beginnings" of a chemical climatology; but although most of what has been done in this department of sanitary enquiry has been commenced and carried out by Dr. Smith, his title is unfair to himself, because he has carried his investigation to the limits of present chemical science.

"Chemistry," says Dr. Smith, "has not hitherto done enough in sanitary enquiries, and it ought to be able to relieve medical men of much of their heavy responsibility, although no subject relating to health can be entirely taken out of their hands." Again, "We rush over the world, scarcely considering that the air we inhale must change at almost every step; and we build our houses, not thinking that every field has a climate of its own, unless circumstances are more nearly the same than we can hope for in our country. In extensive tracts, where soil, level, and inclination are similar, such as great prairies or steppes, there will be few changes until the borders are approached, in which case contiguity of other surfaces will produce a variation. In England, which is a comparatively small country, with much variety of soil, it is difficult to find a place where a short distance does not produce some change; and in Scotland, a still smaller and more varied country, the differences of climate are

even more striking. Indeed, every farmer studies his land in this respect; and the fields are devoted to various purposes, according to climate as well as soil." These quotations serve to show not only the importance of the investigation, but as well the acknowledgment of its importance by the investigator, of whose indomitable energy in the pursuance of his scientific convictions chemists are well aware. The Inspector under the Alkali Act is pre-eminently the one who should commence the systematic study of the subject before us, both because of his scientific attainments and the minute accuracy with which his experiments are made and recorded, telling us exactly how the matter stood when the experiments were commenced, the work done, and the result at completion.

Regnault was the first to begin to refine the study of the air, and to show the distinction in the amount of oxygen in pure and tainted air; a portion of Dr. Smith's work has been to complete and further detail the determinations. The results show the *amount* of difference between the atmospheres of the mountains, of great plains, and of cities. "It is true," says Dr. Smith, "that in figures this appears small; but what is the meaning of small; if we measure size by percentage it will appear small; but still smaller will appear the strychnine that destroys us, if we estimate the amount as a percentage of the weight of our bodies."

We proceed to extract from the voluminous tables some of the most general numerical results:—

Oxygen in the Air.

(Per cent, or, if read as whole numbers, per million).

	Vol. per cent.
N.E. sea-shore and open heath (Scotland)	20·9990
Tops of hills (Scotland)	20·9800
In a suburb of Manchester in wet weather	20·9800
" " "	20·9600
Swampy places, favourable weather, France and Switzerland	20·9220 to 20·9500
In fog and frost in Manchester	20·9100
London, open places, summer	20·9500
In a sitting-room, which felt close, but not excessively so	20·8900
In a small room with petroleum lamp ..	20·8400
Ditto, after six hours	20·8300
Pit of theatre, 11·30 p.m.	20·8300
In sumps or pits in a mine (average of many)	20 1400
When candles go out	18·5000
The worst specimen yet examined in a mine	18·2700
Very difficult to remain in for many minutes	17·2000

"Some people," continues Dr. Smith, "will probably enquire why we should give so much attention to such minute quantities—between 20·980 and 20·999—thinking these small differences can in no way affect us. A little more or less oxygen might not affect us; but supposing its place occupied by hurtful matter, we must not look on the amount as too small. Subtracting 0·980 from 0·999, we have a difference of 190 in a million. In a gallon of water there are 70,000 grs.: let us put in an impurity at the rate of 190 in 1,000,000; it amounts to 13·3 grs. in a gallon, or 0·19 grms. in a litre. This amount would be considered enormous if it consisted of putrefying matter, or any organic matter usually found in waters. But we drink only a comparatively small quantity of water, and the whole 13 grs. would not be swallowed in a day, whereas we take into our lungs from 1000 to 2000 gallons of air daily. The detection of impurities in the air is, therefore, of the utmost importance, and it is only by the finest methods that they can be ascertained in small quantities of air, even when present in such quantity as to prove deleterious to health."

The fraction of a per cent usually considered to be an extremely small quantity, and, if belonging to the second decimal place, unworthy of regard, Dr. Smith shows to be of the highest importance, from the fact that the amount of sulphuric acid in the air is still less than of the carbonic acid, and yet a greater effect is produced on the atmosphere than is indicated by the amount shown in the oxygen or carbonic acid volumes. Thus Dr. Smith concludes that we must pay attention to the number in the second place for oxygen, and that in the case of carbonic acid we must attend to the third even now, and for scientific purposes even to the fourth, or one part in a million. 0·0314 and 0·0400 per cent may mean 314 and 400 in a million: the difference is 86 in a million, a quantity perceptible to the senses; while we must know that the effect of poisons on health is not in proportion to the effect on the sensations. Continues Dr. Smith, "Let us consider what is meant by this 86 in a million. A room twice the size of one not unusual, or two 30 feet long, 24 wide, and 15 high, will contain 21,600 cubic feet, or 37 324,800 cubic inches. If we introduce 0·0086 per cent, we bring 3209 cubic inches of carbonic acid into the room, which will be considered a large amount if put together in vessels: it is nearly 12 gallons. During fogs there will be an addition of nearly five times the amount =60 gallons, or 405 in a million. If we take the numbers found in a very moderately close building, we add 1235 in a million, or fourteen times the first amount, or 168 gallons. If we make the room as close as a crowded theatre, taking the number given for one in London 0·320, we add 2831 in a million, or 377 gallons. And when we come to the state of air in mines we have various numbers, in a few instances rising to more than 2 per cent—nearly a million cubic inches, which would be 578 cubic feet for the supposed room, which does not differ far from this in which I now speak (the Meeting-room of the Literary and Philosophical Society of Manchester)."

The air collected at various stations is contained in a bottle of about 2000 c.c. capacity, or nearly two quarts. About a tenth of a cubic foot of the air is washed with the purest water (previously tested), this water being then submitted to the process for testing waters as given by Messrs. Wanklyn, Chapman, and Smith. The amount of air taken is, of course, accurately measured; and with reference to the organic matter, or even of inorganic salts, many bottles full are necessary. But there is so much new and important material for thought in all the experiments Dr. Smith has made, that to give an extract of his method of working would lead us beyond the limits of a book notice.

Still there is one more quotation to be rendered before we can close this admirable book. In speculating on the dispersion of organic germs, Dr. Smith says:—"We have many people so afraid of this organic matter of the air, and of all its floating particles, that they would like to filter it all out, and breathe the gases pure. We must not allow our fear to go too far. We have no reason to be sure that air free from floating particles would be wholesome; we have only the proof that, if there is an excess of some kind, it is unwholesome. Apparently everyone can breathe air tainted with any disease without being hurt, if the taint is small enough. Inconceivably small particles injure; but we must learn to divide even the inconceivably small. We can bear a larger amount of taint if it is diluted enough. Dilute sufficiently the air of a hospital, and infection ceases. One short time of the infected air produces disease; a long period of the diluted air produces none, although the number of particles that must pass over a certain spot must be much greater in the long time than when the stronger mixture passes in the short time. We learn from this that the amount that does injury is not infinitesimal; there must be a certain quantity. I do not doubt that we shall measure that readily: we can readily measure the amount of ammonia and organic matter in the infectious and non-infectious atmospheres. . . . . I do not feel hopeless of being able to say that in a scarlet-fever atmosphere there must only be so much nitrogenous organic matter and so many germs, otherwise infection will be certain."

Of the data of the second portion of the work, that

on Rain, we have already spoken in our notice of the Report under the Alkali Act, in which the subject-matter was given.

Not only the chemist will be interested in this work of Dr. Smith's; it appeals to the consideration of everyone, that is, of everyone who cares for health and comfort.

Proceedings of the American Pharmaceutical Association at the 19th Annual Meeting held in St. Louis, Mo., September, 1871. Philadelphia: Sherman and Co., Printers.

This large volume contains in the first place the Minutes of the Nineteenth Annual Meeting; even these alone contain a large and highly valuable amount of information on various subjects relating to pharmacy, pharmacognosy, and kindred subjects. Next we meet with the reports of various committees, from which it appears that chemistry is more and more appreciated by the American pharmacists, a fact still better illustrated by the contents of the special and volunteer reports and essays. As we intend reproducing some of the more prominent papers and essays, it is hardly necessary to enter here into more particulars respecting a volume the contents of which speak highly in favour of the advanced state of efficiency, practical as well as theoretical, attained by the large number of American pharmacists. We should wish to see this volume and its predecessors in the library of every pharmacist in this country as a kind of annual cyclopædia on everything connected with pharmacy. The work is enriched with a complete general index to Vols. ix. to xvii. inclusive.

CORRESPONDENCE.

POWERFUL GALVANIC BATTERY.

To the Editor of the Chemical News.

Sir,—It may interest your readers to know that the following cheap and simple battery is nearly 50 per cent higher in potential than a Grove or Bunsen, and fully 150 per cent higher than a Daniell.

For negative, carbon packed in granulated carbon, peroxide of manganese, and precipitated sulphur; the liquid should be dilute acid—sulphuric is best. For positive, zinc in caustic potash or soda.

The potential is higher than any I know, excepting, of course, those which have magnesium, sodium, or potassium for positives.

The internal resistance is rather large; if common salt or chloride of potassium be used instead of caustic alkali, the internal resistance is much less, but the potential sinks to a little more than 10 per cent higher than a Grove. With dilute sulphuric acid on both sides, the resistance is still less, but the potential is only a little higher than a Grove.—I am, &c.,

H. Highton.

2, The Cedars, Putney.

MISCELLANEOUS.

Proposed Association of Manufacturing Chemists.—It having been proposed that the Tyne Social Chemical Society should undertake the organisation of the larger association, a meeting of the members was convened to consider the proposal. The following resolution was carried:—"The Tyne Social Chemical Society is a society of managers and chemists only, and not of manufacturers; and the Council think that the organisation of the proposed association should proceed in the first instance from the manufacturers themselves." We trust that the manufacturers, most of whom admit the desirability of the association, will at once adopt means for its formation.

University of London.—The following are lists of the candidates who have passed the recent B.Sc. and Preliminary Scientific Examinations:—*First B.Sc. Examination*—First Division. James Barnes, Owen's College; Cornelius Bulbeck, Private Study; Edward Albert Butler, B.A., private study; Frederic Chapple, B.A., Wesleyan Tr. and University Colleges; Claude Clarke Claremont, University College; Henry Wade Deacon, King's College; Frederick William Frankland, University College and Royal School of Mines; Arthur Walton Fuller, Owen's College; James Edward Harris, B.A., private study; Richard Henry Jude, Christ's College, Cambridge; John Frederic Main, private study; Arthur Milnes Marshall, B.A., St. John's College, Cambridge; Arthur Samson Napier, Owen's College; John Edward Neale, University College; Henry Shoveller Roberton, B.A., Old Trafford School and Owen's; John Charles Saunders, Downing College, Cambridge; Jas. Heber Taylor, M.A. Camb. and Oxon., Trinity College, Cambridge; James Cecil Witton, private study; William Barton Worthington, Owen's College. Second Division. Richard John Anderson, Belfast College; Frederic Harvey Barling, Owen's College; Judson Sykes Bury, Owen's College; Adam Speers, private study; Edward Worsdell, B.A., Flounders College. *Preliminary Scientific (M.B.) Examination.*—First Division. John Henry Barnard, private study; William Henry Blake, University College; James Blamey, University College; Harry Beecham Briggs, King's College; Robert Edmund Carrington, Guy's Hospital; Claude Clarke Claremont, University College; Charles Walter Evans, University College; Richard Hingston Fox, London Hospital; George Aldridge George, University College; Francis Goodchild, Epsom and University Colleges; John Benjamin Hellier, Leeds School of Medicine; George Courtenay Henderson, University College; Wilfred Francis Hopwood, Manchester Grammar School; Edwin Joseph Le Quesne, St. Bartholomew's Hospital; Howard Griffiths Lowe, Queen's College, Birmingham; Arthur Milnes Marshall, B.A., St. John's College, Cambridge; Charles Arthur Mercier, London Hospital; John Edward Neale, University College; Howard Douglas Stewart, King's College; Nestor Isidore Charles Tirard, King's College; Benjamin Arthur Whitelegge, University College; James Cecil Witton, private study; William Barton Worthington, Owen's College. Second Division. Richard Jonn Anderson, Belfast College; Albert de Winter Baker, Guy's Hospital; Richard Legg Batterbury, King's College; Henry Blake, St. George's Hospital; Judson Sykes Bury, Owen's College; Herbert Duke, Guy's Hospital; John Christian Ferrier, Guy's Hospital; Alfred Finch, Guy's Hospital; George Michael James Giles, St. Mary's Hospital; Alexander Gray, Guy's Hospital; John Gatchell Hancock, King's College; Joseph William Hunt, University College; Alfred James, University College; Richard Henry Jude, Christ's College, Cambridge: Walter Aubrey Kidd, Guy's Hospital; William Henry Maberly, Edinburgh University; Frederick Daniell Miller, King's College; Thomas Mark Pinnell, University College; Joshua Powell, University College; James Woolley Roughton, King's College; William Joseph Seward, University College; William Allason Simmonds, Guy's Hospital; Edward Arthur Snell, King's College; Arthur Bayly Vanes, Queen's College, Birmingham; Sidney Patteshall Wilding, University College.

Trial of the Pyx.—This annual trial of the weight and purity, according to Standard, of the gold and silver moneys coined at the Royal Mint during the past year, was held on July 19th at the Goldsmith's Hall, in pursuance of the provisions of the Coinage Act, 1870, 33rd Victoria, cap. 10. This trial of the Pyx is one of the most ancient customs we retain. The following extract from the first schedule of the Coinage Act, 1870, will show at a glance the delicacy of test to be observed by the jury in weighing, and assaying the various moneys submitted to their trial, and the closeness to Standard

to which the officers of the Mint are compelled to work. The Imperial weight in grains only is here given :—

Coin.	Weight.	Remedy.
Sovereign	123·27447 ..	0·20000
Half-sovereign ..	61·63723 ..	0·10000
Florin..	174·54545 ..	0·72727
Shilling	87·27272 ..	0·36363
Sixpence	48·63636 ..	0·18181

The Standard fineness for gold coins is 11-12ths fine gold, and 1-12th alloy, or millesimal fineness 916·66; the remedy or margin allowed to the Master of the Mint on coinage, being millesimal fineness 0·002. For silver coin the Standard fineness is 37-40ths fine silver and 3-40ths alloy, or millesimal fineness 925·0, the remedy being millesimal fineness 0·004. Before the jurors proceeded to the laboratory to commence their operations, they were furnished with small portions of the standard trial plates, in the custody of the Board of Trade, to guide them in their assay of the coins deposited in the Pyx. The amount of gold moneys coined at the Mint from the 1st of July, 1871, to the 30th of June, 1872, was £13,298,658, out of which coins to the value of £18,718 were deposited in the Pyx, or box, consisting of 18,464 sovereigns and 508 half-sovereigns: and the amount of silver moneys so coined within the same period was £996,138, out of which coins to the value of £357 18s. 6d. were likewise deposited in the Pyx, consisting of 2508 florins, 1798 shillings, and 646 sixpences; and of Maundy moneys, two fourpences, 80 threepences, 2 twopences, and 6 one-penny pieces. The average amount of gold coined during each year is five millions, but this year, owing to many causes, the Mint has been called upon to coin thirteen millions of gold, and more than three times the amount of silver moneys coined in 1870. This enormous increase in the supply of currency has only been met by immense exertion on the part of the authorities and workmen of the Royal Mint. Besides their labours to meet the public requirements of this country and trade generally, the Mint has been called upon to coin a large amount for the Colonies. We extract the following from the verdict, which was most satisfactory to the public and the Mint Authorities, and reflects great credit on Mr. W. Chandler Roberts, the Queen's Assay Master. "We then melted the said gold coins, making altogether 71 sovereigns and 6 half-sovereigns, so taken out and weighed, into an ingot, and assayed such ingot, comparing it with the Standard gold trial plate produced by the Board of Trade so as to ascertain whether the metal was within the remedy as to fineness prescribed in the said first schedule to the said Act; and we found that there was *no variation* thereof from the Standard of fineness specified in the said first schedule to the said Act." (The standard is 916·66. The ingot was 916·66 exactly. Coins would be legal if they contained 918·66 or 914·66 parts of gold in 1000·00 of alloy.) . . . . We then assayed six sovereigns and three half-sovereigns separately, and we found the millesimal fineness of such sovereigns to be 916·9, 916·7, 916·5, 917·2, 916·6, 916·6, respectively, and the millesimal fineness of such half-sovereigns to be 916·6, 916·6, 916·6, respectively.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, July 1, 1872.

This number contains no original papers relating to chemistry, but we quote the titles of the following interesting memoirs :—

Optical Phenomenon Observed During an Aërostatic Journey with an Air-Balloon.—G. Tissandier.—Illustrated by a woodcut.

Observations Made During an Aerostatic Journey with the Air-Balloon Named La Lea.—W. de Fonvielle.

July 8, 1872.

This number contains the following original papers and memoirs more particularly relating to chemistry :—

Influence of Pressure on the Phenomena of Endosmosis and Oxosmosis.—Dr. Becquerel.

Effects of Slow Action (Action Lente) Produced During a Number of Years.—Dr. Becquerel.—This paper contains the account of the results of some experiments which prove that, by slow but continued action, curious effects may be obtained; for instance—Crystals of arragonite are formed upon a piece of gypsum (lance-shaped variety) kept in a closed vessel in a solution of bicarbonate of potassa; the gypsum has almost entirely disappeared, having become converted into arragonite. A similar piece of gypsum, placed in a solution of arseniate of ammonia, has been converted into arseniate of lime. With a solution of aluminate of potassa and gypsum, the result is the formation of glauberite (double sulphate of lime and potassa, the latter substituted for the soda in the mineral just named). Pieces of galena, kept for twenty years in a solution of bicarbonate of potassa, have yielded well-defined crystallised carbonate of lead. When pieces of limestone were immersed into a solution of plombite of potassa (solution of oxide of lead in caustic potassa), the result was the formation of beautifully-crystallised hydrated carbonate of lead; malachite has been obtained by the action of limestone upon nitrate of copper, converting it into subnitrate, which, in its turn, is converted into malachite by bicarbonate of soda.

Dissolving Effect of Carbonic Acid upon Carbonate of Lime. T. Schlœsing.—The second instalment of a lengthy memoir on this subject; this portion is elucidated by several algebraical formulæ and tabulated forms exhibiting results of researches.

Preparation of Aniline Colours.—Ch. Lauth.—The main gist of this paper is a refutation of an assertion made by Girard and De Laire, to the effect that the industrial manufacture of the aniline colours was highly dangerous and injurious, in consequence of the use of arsenic acid. The author of this paper says that, with due preeautions, there is no danger either to the workmen engaged or to the neighbourhood of the colour-works.

Observations on Girard and De Laire's Paper on the Colouring Matter Derived from Diphenylamine.—Dr. Bardy.—This short paper is published with the view of establishing the author's priority of discovery in reference to methyl-diphenylamine, as proved also by his paper in the *Comptes Rendus*, vol lxxiii., p. 751.

Primary Spectrum of Iodine.—G. Salet.

Compressibility of Liquids under High Pressure.—L. Cailletet.—This paper contains the detailed account of a series of experiments, the results of which we quote in the following manner:—

	Density (Sp. gr.).	Temperature.	Compressibility.	No. of Atmospheres Pressure.
Distilled water free from air	1·000	8°	0·0000451	705
Sulphide of carbon	—	8°	0·0000980	607
Alcohol	0·858	9°	0·0000676	174
		9°	0·0000701	305
		11°	0·0000727	680
Petroleum oil.. ..	0·865	11°	0·0000828	610
Petroleum essence (benzoline)	0·720	10·5°	0·0000981	630
Sulphuric ether ..	—	10°	0·0001440	630
Sulphurous acid (fluid)	—	−14°	0·0003014	606

Analysis of a New Variety of Amblygonite from Montebras (Creuse), of the Amblygonite from Hebron (Maine, U.S.), and of the Wavellite from Montebras.—F. Pisani.—After referring to his former researches on this subject, and also to those of Des Cloizeaux, the author states that there exist two different varieties of amblygonite, viz., the lithico-sodic of Montebras and Saxony (Penig, analysed by Dr. Rammelsberg), and the lithic amblygonite of Montebras and of the United States. The chemical composition of the Penig and Montebras varieties are quoted as follows:—Penig—Fl, 8·11; PhO_5, 47·58; Al_2O_3, 36·88; LiO, 6·68; NaO, 3·29; KO, 0·43. Montebras—Fl, 8·20; PhO_5, 46·15; Al_2O_3, 36·32; LiO, 8·10; NaO, 2·58; MnO, 0·40; HO, 1·10. The wavellite of Montebras consists, in 100 parts, of—Phosphoric acid, 34·30; alumina, 38·25; water, 26·60; fluorine, 2·27; total, 101·42.

Third Bichlorated Propylen.—C. Friedel and R. D. Silva.—In this lengthy memoir the authors describe the results of their researches, which led to the discovery of a new bichlorated propylen boiling at 106°, the formula of which is—

$$\begin{matrix} CH_2Cl \\ CH \\ CHCl \end{matrix}$$

The formulæ and boiling-points of the two other bichlorated propylens are—

$$75°,\ \begin{matrix} CH_3 \\ CCl \\ CHCl \end{matrix}\ ;\quad 94°,\ \begin{matrix} CH_2Cl \\ CCl \\ CH_2 \end{matrix}$$

General Theory of Chemical Action; Two New Acids Obtained by the Oxidation of Sugar.—E. J. Maumené.—By the limited oxidation of sugar by means of the cautious application of permanganate of potassa, the author has obtained two new acids, which

he terms hexépic and trigenic acids; the formula of the former is $C_{12}H_{12}O_{16}$, and of the other $C_6H_6O_{10}$.

Aldehydes Condensed with Elimination of Water, or Aldanes.—J. Riban.—This lengthy monograph treats on the action of sodium and zinc upon the following aldehydes:—Acetic, valeric, benzoic, and aceton (this body is not acted upon by the metals just named at a higher temperature). The new substances which are formed from the aldehydes are termed by the author aldanes.

Thermo-Chemical Researches on the Bodies Formed by Double Decomposition.—Drs. Berthelot and Longuinine.—The third instalment of an exhaustive monograph; this part treats on the decomposition which the chlorides, iodides, and bromides of phosphorus undergo with water.

July 15, 1872.

Absence of Combustible Gases in the Fumes Emitted by the Caldeira de Furnas, at San-Miguel (Azores).—C. Sainte-Claire Deville.—The author has analysed the gases evolved with steam by the hot springs of the locality alluded to. It appears that only carbonic acid and sulphuretted hydrogen are present, whereas in the gases emitted with steam by the Geysers, in Iceland, hydrogen was found by Dr. Bunsen, and in the Lagoni of Tuscany hydrogen were detected by the author and M. Le Blanc.

Instantaneous Oxidation of Alcohol.—A. Houzeau.—By means of ozone, obtained by the apparatus invented by the author, absolute alcohol is in a few seconds converted into aldehyde and acetic acid, with formation of peroxide of hydrogen; ether is similarly acted upon by ozone.

Estimation of Urea by means of Millon's Reagent and the Mercurial Pump.—N. Gréhaut.—This physiologico-chemical essay contains the detailed description of a process of estimating urea by first converting it into carbonic acid and nitrogen, and then estimating the quantity of these gases.

This number also contains several important papers relating to physiology, geology, meteorology, and mechanical sciences.

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt, No. 1, 1872.

This number contains no papers strictly relating to chemistry, but we quote the titles of the following important memoirs:—

Ironstone Deposits of the Styrian Iron-Works Association.—F. Ritter von Hauer.—Illustrated with a map printed in colours.

Future of the Mining Industry in Austria.—C. Baron von Beust.

Added to and bound up with this number is a small volume, bearing the title of Mineralogical Notices, from which we quote the following:—

Chemical Examination of the Gopalpur Meteorite.—A. Exner.—The percentical composition of this stone was ascertained to be—Iron, 20·96; cobalt, 0·10; nickel, 1·80; sulphur, 1·74 (corresponding to 4·83 per cent of sulphuret of iron and 19·77 per cent of nickel-iron); silica, 37·44; protoxide of iron, 11·94; protoxide of manganese, 0·26; magnesia, 19·72; alumina, 2·52; lime, 1·60; potassa, 0·21; soda, 0·62; oxide of chromium, traces—of the last-named bodies, 28·63 per cent is soluble, and 45 67 per cent is insoluble, in hydrochloric acid.

Researches on Limestones and Dolomites as a Contribution to our Knowledge on Metamorphisms.—A. von Inostranzeff.—This essay, illustrated by a large number of engravings, contains the results of analyses of limestones and dolomites from various countries.

Polytechnisches Journal von Dr. E. M. Dingler, second number for June, 1872.

This number contains the following original papers and memoirs relating to chemistry, &c.:—

Description of a Dephosphorising Puddling Process for the Purpose of Preparing Good Malleable Iron from Pig-Iron which Contains Phosphorus.—Dr. T. Scheerer.—In the puddling process, the chlorides of calcium and sodium are used by the author for removing phosphorus from pig-iron. The quantity of the ingredients depends upon the quantity of phosphorus present in the pig-iron; supposing it is 2½ per cent, then the quantity of the chlorides to be added to a puddling charge of 3½ cwts. will be $=2\frac{1}{2}\times3\frac{1}{2}\times3=26\frac{1}{4}$ lbs. By the application of this process, a very good and fibrous malleable iron is obtained.

Change of a Bronze by having been for a Long Time Buried in the Earth.—E. Priwoznik.—This paper contains the account of some researches made with bronze ornaments found in an ancient burial-ground at Salzberg, near Hallstatl (Austria). The composition of the metal was ascertained to be—Copper, from 90 to 92 per cent; tin, 6·5 to 9; in addition to these, small quantities of iron, arsenic, nickel, silver, cobalt, lead, and sulphur. The outer layer of the objects made of this metal, and buried in the earth for a very long time, was essentially found to consist of—Sulphur, 33·22; copper, 66·77 (the formula CuS requires—S, 33·54; Cu, 66·46). A second more inner layer was found to have been converted into Cu_2S, mixed with 15 per cent of tin, which is not met with in the outer layer. The third layer was found to consist of—Cu_2S, 59·8 per cent; tin, 23·2; water, 3·4; traces of antimony and nickel. None of these crusts or layers contained any lead, zinc, or silver.

Method of Obtaining Sugar from Molasses (Beet-Root).—M. Sebor.—The extensive report on an improved method of recovering from beet-root molasses the crystallisable sugar it contains; the process is based upon the use of saccharate of lime.

Effect of some Methods of Boiling Down Sugar Solutions in Vacuum-Pans.—E. Jicinsky.—The contents of this paper, elucidated by a series of tabulated forms exhibiting results of experiments made on the large scale, relate to practical sugar-refining.

Journal für Praktische Chemie, No. 10, 1872.

This number contains the following original memoirs and papers:—

Some New Derivatives of Albumen.—O. Loew.—Very-quickly-dried albumen has been treated with pure monohydrated nitric acid, care being taken to cool the mixture; the result is the formation of trinitro-albumen, the formula of which (that of albumen being taken as $C_{72}H_{103}N_{18}SO_{22}$) is—

$$C_{72}(NO_2)_3N_{18}SO_{22}.H_{103}$$

This substance is a yellow-coloured, tasteless, solid body, insoluble in water, alcohol, and ether, soluble in dilute alkaline liquids without decomposition, and precipitable from these solutions by acids; it is decomposed and carbonised by heat. This compound forms salts with lime and lead; the latter combination contains 31·01 per cent of lead. Another compound obtained by the author is oxytrinitro-albumen, a yellow-coloured solid substance, soluble in lime-water, and precipitable therefrom by means of alcohol.

Quantity of Water Contained in the Protosulphate of Iron and Ammonia.—Dr. E. Fleischer.—This essay reviews at length the results of the researches of Dr. Rheineck on this subject, and also contains the results of the author's experiments, which lead to the formula $FeOSO_3,NH_4OSO_3+6aq$ for the protosulphate of iron and ammonia.

Preparation of Propionic from Lactic Acid.—Dr. A. Freund.—This lengthy essay contains an account of a series of experiments made with the view of obtaining propionic acid directly from lactic acid by means of hydriodic acid. The author enters into a lengthy discussion on the by-products which are formed in this operation, and also on some of the derivatives of the propionic acid.

Chemical Composition of Maxite.—H. Laspeyres.—This paper treats on a new mineral, named maxite, found in the lead-mine of Mala-Culzetta (Island of Sardinia), and consisting, in 100 parts, of—CO_2, 8·082; H_2O, 1·866; SO_3, 8·140; PbO, 81·912. Formula—

$$5(PbO.SO_3)+9(PbO.CO_2)+4PbO.5HO.$$

Oxysulphide of Carbon.—F. Salomon.—The contents of this essay may be summarised as follows:—The salts obtained by Debus from xanthogenic acid ether, and by Bender from oxysulphide of carbon and alcoholic potassa solution, are identical, and are composed according to the following formula:—

$$(CS)\begin{matrix}OC_2H_5\\OK\end{matrix}$$

The decomposition of the last-named salt, by means of hydrochloric acid, yields pure oxysulphide of carbon; this body may be prepared indirectly from oxide of carbon and sulphur, by causing the crude oxysulphide to be absorbed by alcoholic potassa solution, and next treating the ensuing crystalline compound with hydrochloric acid. It is not probable that there exist two isomeric oxysulphides of carbon.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 13, 1872.

On some Ketons.—E. Schmidt.—This exhaustive monograph treats at great length on the following bodies:—Aceton, CH_3COCH_3, boiling-point 56°. Propion, $C_2H_5COC_2H_5$, 100°. Butyron—

$$C_3H_7COC_3H_7,$$

144°. Valeron, $C_4H_9COC_4H_9$, 181° to 182°. Capron, $C_5H_{11}COC_5H_{11}$ 220° to 221°. Œnanthon, $C_6H_{13}COC_6H_{13}$, 264°. Caprylon—

$$C_7H_{15}COC_7H_{15},$$

178°. Methyl-capron, $CH_3COC_5H_{11}$, 155° to 156°.

Contribution to the History of the Phosphurets of Iron.—C. Freese.—While calling attention to Sidot's phosphuret of iron (see CHEMICAL NEWS, vol. xxv., p. 299), the author states that some five years ago he pointed out that such a phosphuret of iron (Fe_4P) does not exist (*Pogg. Ann.*, bd. cxxxii., p. 225), and the non-existence of this substance also upsets the theory of Maumené.

Estimation of Manganese in Pig-Iron, Steel, and Malleable Iron.—F. Kessler.—Reserved for full translation.

Reduction of Isoxylol and of the Aromatic Hydrocarbons in General.—F. Wreden.—After first referring at some length to the researches of Drs. Baeyer and Berthelot, the author states that he succeeded in reducing isoxylol by the aid of red phosphorus (amorphous) and concentrated hydriodic acid, these substances being placed in strongly-made glass tubes, which, after having been sealed, were heated for the first twelve hours to 170°, and for another twelve hours to 240°. The result of this operation, followed by a complicated process of purification, is the formation of a hydrocarbon, a mixture of C_8H_{16} and C_8H_{18}, in the proportion of 84·9 per cent of the former and 15·0 per cent of the latter.

Azophenylen from Para-Azobenzoic Acid (Azodracylic Acid).—A. Claus.—It appears that the azophenylen obtained from para-azobenzoic acid is identical with that obtained from azobenzoic acid. Azodracylate of lime yields, by dry distillation, a solid product, which, after having been purified, exhibits yellow-coloured needle-shaped crystals, fusing at 171°, and soluble in alcohol, water, and ether.

Action of Cyanide of Potassium upon Iodide of Allyl.—A. Olaus.—This paper contains the account of the results of some experiments which are not yet completed, from which the author concludes that, by the reaction of cyanide of potassium upon iodide of allyl in sealed tubes, an acid is formed which is identical with pyrotartaric acid.

Indications of the Mercurial Calorimeter.—J. Thomsen.—The contents of this lengthy essay are chiefly written to prove that the mercurial calorimeter cannot yield constant and reliable results, and that therefore the experiments made by Favre, Valson, and others with this instrument, and the conclusions drawn from these experiments, are not correct.

Detection of Chlorine, Bromine, and Iodine in Organic Substances.—F. Beilstein.—The organic substances which contain these halogens—for instance, chloroform, iodmethyl, chlortoluol—are ignited in the blowpipe-flame, after having been placed on a small quantity of oxide of copper (kept by means of a small loop of platinum wire). The oxide of copper and halogen-containing organic substance yield a peculiar green or blue colouration to the blowpipe-flame.

Allyl-Alcohol Cyanide.—B. Tollens.—By causing a current of cyanogen gas to be absorbed by allyl-alcohol while warm, the author has obtained allyl-alcohol dicyanide, $C_3H_5(CN)_2OH$, a colourless fluid boiling at 151°.

Crystalline Forms of Dibenzyl and Stilben.—Th. Zincke.—A purely crystallographical essay, illustrated by several woodcuts.

On Terpen-Bibromide.—R. Biedermann and A. Oppenheim.—Terpen-bibromide yields, by oxidation with chromic acid (bichromate of potassa and sulphuric acid), terephthalic acid and a small quantity of a camphor-like substance containing bromine, probably the monobromhydrate oil of turpentine, $C_{10}H_{17}Br$.

Cymol from Oil of Turpentine and from Essential Oil of Lemons.—A. Oppenheim.—This essay contains the detailed account of a series of experiments to ascertain the real constitution of the essential oils by preparing from the same cymols. The cymols of terpen and citren boil respectively at 176° and 179°. The products of oxidation of cymol from terpen and citren are identical, being chiefly terephthalic acid.

Artificial Formation of Camphor.—A. Oppenheim.—While oxidising terpen-cymol, the author obtained a small quantity of a solid body which, on being analysed, proved to be camphor, which has thus been synthetically formed.

Some Derivatives obtained from Solid Dibrom-Benzol.—V. Meyer and C. Wurster.—This exhaustive monograph is divided into the following sections:—Action of ammonia upon nitro-dibrom-benzol; phenyl-diamine from bromnitro-amidobenzol.

Formation of Sulphuric Acid and Urea, and the Behaviour of Taurine in the Animal Body.—E. Salkowsky.

Journal de Pharmacie et de Chimie, July, 1872.

The following original papers and memoirs are contained in this number:—

General Method of Immediate Organic Analysis.—Dr. Fleury.—The first instalment of an essay, illustrated by a woodcut exhibiting an apparatus for exhausting organic substances with ether, treating at great length on the immediate organic analysis. This part is divided into the following sections:—Estimation of water; treatment with ether.

Double Fusion-Point of a Vegetable Wax obtained from Japan, and on the Application of that Wax in Pharmacy.—Dr. C. Roucher.—The wax here alluded to is the product of the *Rhus succedaneum*, and is now a common article of commerce. It is harder than bleached bees'-wax, but more readily fusible. The fusing-point is stated to be at from 40° to 42°; but, on experimenting with two different samples, the author found that in reality the wax has two different fusion-points, for, on being heated cautiously from 40° to 45°, it does not become liquid, but simply softens, and remains opaque. On being further heated from 45° to 50°, it becomes transparent without becoming quite fluid; at 54°, however, the wax is quite molten. If suddenly heated to above its fusion-point, and, after having been somewhat cooled, it is placed in water at 42°, it again fuses, becoming quite fluid. The fusion-points are therefore 42° and 54°. Japan wax is not a solitary instance of this anomaly, since, according to Duffy, natural stearine (*stearine naturelle*), exhibits three modifications, fusing respectively, α at 51°, β at 63°, and γ at 66°. Bees'-wax fuses at from 62·5° to 64°.

Qualitative and Quantitative Analysis of a Mixture of Essential Oil of Bitter Almonds and Nitrobenzine.—E. Bourgoin.—The author uses caustic potassa (solid) as a qualitative test for detecting in essential oil of almonds the presence of nitrobenzine, which, if present, causes along with the potassa a reddish brown colouration of the originally yellow-coloured fluid; this colouration afterwards turns green. For the purpose of quantitative analysis, the suspected sample (some 5 to 10 grms.) is first mixed with from 20 to 40 grms. of a very concentrated solution of bisulphite of soda. This mixture is thoroughly shaken in a stoppered bottle large enough to hold at least 100 grms. of fluid; ether is then added, for the purpose of dissolving the nitrobenzine, and this ethereal solution is cautiously evaporated upon a water-bath and the residue weighed. The residue (nitrobenzine) may be further converted into aniline by the aid of acetic acid and iron filings.

Study on the Fluid Secreted in Pleuritis.—Dr. Méhu.—This paper treats on a medical, rather than a chemical, subject. It appears that the serous fluids secreted in various pathological processes all contain about the same quantity of mineral salts—viz., from 7·5 to 9 grms. to the kilo. The sp. gr. of these fluids depends in a measure upon the larger or smaller quantity of fibrine they contain.

Observations on Orange-Flower Water Distilled by means of Steam.—M. Vuaflart.—It appears that the practice of obtaining the water alluded to, by passing a current of steam over the flowers placed in a suitable vessel connected with a condenser, leads to the rapid deterioration of this aromatic water; while the same remark applies to rose and other similar waters used in pharmacy. The author states that aromatic waters prepared by the old method keep far better, and are more agreeably flavoured than those submitted to the steaming process.

Estimation of Phosphoric Acid in the Presence of Iron and Alumina.—A. Adriaanzs.—The process of Dr. Chancel (estimation of phosphoric acid by means of bismuth) is modified by the author in the following manner:—To the chlorhydric solution of the substance in which the phosphoric acid is to be estimated hyposulphite of soda is added first, so as to reduce the peroxide of iron to protoxide; next, nitrate of bismuth is added, and the vessel containing the substances heated for about four hours upon a water-bath. The precipitate which is formed is filtered off after twenty-four hours, and after having been well washed is dissolved in nitric acid. The chlorhydric and sulphuric acids present in this solution are next first eliminated by means of nitrate of silver and nitrate of baryta, while the phosphoric acid is afterwards thrown down by means of nitrate of bismuth. The phosphate of bismuth precipitate is collected on a filter, washed, and lastly dissolved in chlorhydric acid and estimated as ammonio-phosphate of magnesia in the presence of citrate of ammonia. This process may even be employed when the substance contains fifty times more alumina than phosphoric acid; but if the proportion of alumina be very large, it is best to add to the substance a weighed quantity of pure phosphate of soda. If the iron might happen to be present in very large excess, it is necessary to re-dissolve the first bismuth precipitate and re-precipitate it a second time.

La Revue Scientifique de la France et de l'Etranger, July 6 and 13, 1872.

These numbers do not contain any original papers relating to chemistry.

Les Mondes, July 25, 1872.

This number contains no original papers relating to chemistry, but under the heading Bibliography we notice the following work:—"Premier Siècle de l'Academie Royale de Belgique," par M. Quetelet (grand 8vo.; Bruxelles: Hayes, imprimeur; 1872). The highly distinguished author of this work, who is perpetual secretary of the Royal Belgian Academy of Sciences, Lettres, and Beaux Arts, relates in this volume the history of the institution originally founded by the Empress Maria Theresa as sovereign of the then (1772) Austrian Netherlands.

NOTES AND QUERIES.

Glacial Sulphuric Acid.—Can any of your readers give me information as to price and names of manufacturers of anhydrous sulphuric acid?—S. R. P.

Glue to Hold against Fire.—Mix a handful of quicklime in 4 ozs. of linseed oil, boil them to a good thickness; then spread it on tin plates in the shade, and it will become exceedingly hard, but may be easily dissolved over the fire, and used as ordinary glue.—X. Y. Z.

Rendering Paper Sensitive to Electric Current.—Will you inform me what is the best solution wherewith to saturate paper so that the latter, when *dry*, will become sensitive (by decomposition) to electricity, showing a blue or black mark wherever the current passes? Ferrocyanide of potassum is unsuitable, because the current will not make a mark on it unless the paper is *damp*.—T. R.

[There is no practical method of rendering *dry* paper sensitive to the electric current, because dry paper is almost a non-conductor to intense currents, and quite so to ordinary quantity currents. Imperfect impressions may be obtained by employing extremely thin paper, upon which has been smeared starch-jelly (that used by laundresses), containing a few grains of potassium iodide, the electrodes being one on each side of the paper, and the current obtained from an induction-coil giving, at least, a quarter-inch spark. With clean electrodes, the first impression (the starch-jelly being dry) will probably be a good one, the second imperfect. But why not use dry ferrocyanide paper re-damped simply with water? With one electrode of iron the current from a single cell will then produce a clear impression.]

TO CORRESPONDENTS.

H. E. W.—Salter's Edition of "Field's Chromatography."

J. McL.—We believe a work on the subject was written by Liebig in 1848. Consult also works on Forsenic Medicine.

A. H. Allen, E. Sonstadt, W. Chandler Roberts, B. J. Grosjean, W. Crowder, Professor Galloway.—These correspondents are thanked for their communications.

THE CHEMICAL NEWS.

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ON METEORIC STONES.*

By NEVIL STORY-MASKELYNE, M.A., F.R.S.

The substantial unity of the celestial objects distinguished in common language by the names shooting or falling stars, fire-balls, and meteorites, and, further, the coincidence in many important respects of these with comets, and possibly with the zodiacal light, were suggestions made by Humboldt in the "Cosmos," which have received much confirmation from the subsequent advance of science.

The greater apparent velocity with which the ordinary meteors traverse the atmosphere as compared with that with which the less frequent larger bodies are seen to move, the marked periodicity that attends the recurrence of the former in several, and especially in two, notable cases of meteor showers, offer an apparent contrast between these classes of meteors; it is not, however, in all probability, a real contrast, for the one class passes into the other by every gradation in the magnitude of the mass or masses of which the meteor consists, and consequently in the grandeur of the phenomena which accompany its advent. If of the material composing the ordinary falling star we have never yet been able to recognise any vestiges as reaching the earth, of the meteorite, on the other hand, the mineral collections of Europe contain numerous carefully collected specimens, which are the fragments that have escaped the fiery ordeal of the transit through our earth's atmosphere, and in these we recognise masses composed either of iron (siderites), or of stones (aërolites), or of a mixture of the two (siderolites). The phenomena associated with such falls of meteoric matter have been described in very similar language by those who have witnessed them in various parts of the world, and these accounts, whether coming from European observers or from Hindoo herdsmen (of which some were read by the lecturer), concur generally in the approach of the meteorite as a fiery mass, emanating from a cloud when seen by day and exploding often with successive detonations that are heard over a great extent of country, even in certain cases at points more than 60 miles distant, but finally reaching the earth with a velocity little higher than what might be due to the motion of a falling body. Externally these meteoric masses are generally hot when they fall; sometimes, however, they are not so; the discrepancies in the accounts being explained by one authenticated case in which the mass was internally intensely cold, though at first hot externally. The fallen meteorite is invariably coated with an incrustation, sometimes shining as an enamel, generally black, but occasionally colourless where the aërolite is free from ferrous silicates; and this incrustation is seen to have been formed in the atmosphere, since it is found coating surfaces of fragments that have been severed by the explosions in the air.

Aërolites frequently fall simultaneously in large numbers, many thousands of them being in such cases spread over a surface of the country some miles in extent; and such showers of stones seem to have entered the atmosphere as a group, though their numbers must subsequently have been greatly increased by the division accompanying their detonation.

The explanation of the incrustation and of the cloud left by the meteorite, or out of which it seems to emerge, is found in the transformation into heat of the energy actuating a body that enters our atmosphere with a motion of 12 to 40 miles a second. The velocity of the body is almost instantaneously arrested by the atmospheric resistance, and in a very few seconds the mass becomes, comparatively speaking, stationary. Its surface must, as a consequence, be immediately fused, and the melted matter would be flung off from it into the surrounding air, fresh surfaces continually affording new fused material to form the cloud of, so to say, siliceous spray that lingers along and around the path of the meteorite.

When the mass is small,—and in the case of meteoric showers and ordinary falling stars it cannot exceed a few ounces, and may often be but a few grains,—the whole material is thus consumed, and must ultimately fall as an unperceived, because widely-scattered, dust. The meteorite is the residue that survives this wasting action where the magnitude of the mass is more considerable. The cause of the violent and often successive explosions is probably to be sought in the expansion of the outer portions of the mass, while the interior retains the contracted volume due to the intense cold of space with which the meteorite enters the atmosphere.

From time to time these contending conditions of volume may, as in a Prince Rupert's drop, produce explosion, the heated shell in the case of the meteorite flying off in fragments from the internally cold inner core, which if sufficient velocity remain to the mass will undergo a recurrence of the same conditions of surface fusion and explosion. The loudness of the detonation is also probably enhanced by the simultaneous collapse of the air on the vacuum that would follow the rapidly moving mass.

The pitted surface characteristic of meteorites probably bears witness to a similar effect of unequal dilatation operating more especially in the freshly-broken surfaces of the mass, small fragments splintering off in this way from the cold and brittle stone under the sudden influence of intense heat.

A remark made by Humboldt, that light and meteorites are the only sources of our knowledge regarding the universe external to our world, points to the true ground for our interest in the waifs and strays of extra-telluric matter that thus fall upon our globe.

In physical as well as in chemical characters aërolites resemble at the first aspect some terrestrial volcanic rocks.

The minerals of which they are composed are nearly entirely crystalline, as is evidenced by the colours in polarised light of such as are transparent. These minerals are usually aggregated with slight cohesion, and they present in by far the greatest number of cases a peculiar spherular or "*chondritic*" structure.

In these the spherules are composed of similar minerals to those which enclose them, and even contain metallic iron sometimes in microscopically fine grains disseminated through them.

A section of an aërolite was exhibited by the microscope in which some of the spherules had been broken before being cemented by the surrounding mass, and in another fissures were seen which had been filled with a fused material after one side of the fissure had slidden along the other; facts pointing to events in the history of the meteorite subsequent to its first formation.

The chemical composition and the mineral constitution of aërolites were illustrated by tables showing the elements met with in these bodies, and the minerals in which they were distributed. The former comprised about one-third of the known elements; among them magnesium, iron, silicon, oxygen, and sulphur were conspicuous; calcium, aluminium, nickel, carbon, and phosphorus coming next in importance, the basic elements of most importance by their amount being the same as those which are found by spectroscopic analysis to be present in the sun—and in those stars which have been the best examined.

The minerals most frequent in aërolites besides nickeliferous iron or troilite (iron monosulphide) and graphite,

* Read before the Royal Institution of Great Britain.

are bronzite (a ferriferous enstatite) and olivine, both of the latter being essentially magnesium silicates. Augite and anorthite also occur (more particularly in the eukritic aërolites of Rose) and some minerals unknown in terrestrial mineralogy have also been met with; such are the different varieties of Schreibersite (phosphides of iron and nickel); calcium sulphide, asmanite (a form of silica crystallising in the orthorhombic system and having the specific gravity of fused quartz), and a cubic mineral with the composition of labradorite. The crystalline form of bronzite was first determined from the crystals in a meteorite, and was found to confirm the conclusion Descloizeaux had arrived at as regards its system from observations on the distribution of the optic axes in the terrestrial bronzite and enstatite.

The question as to whence the meteorites come is one that we are not yet in a position to answer with certainty. The various hypotheses which suppose for them an origin in lunar volcanoes, or in our atmosphere, or again in a destroyed telluric satellite, or that would treat them as fragments of an original planet of which the asteroids are parts, or as masses ejected from the sun; all these hypotheses seem to be more or less precluded by the known velocities, the retrograde motion so frequently chacterising meteors and meteorites, or else by the chemical conditions that, for instance, are involved in the passage of the meteorite through the sun's chromosphere. Whether meteorites move or do not move in circumsolar orbits is at present impossible to say; because, while with our incomplete knowledge we cannot to-day attach the character of periodicity to any known class of meteorites, we are not justified in founding any conclusion on a negative result with so limited a foundation.

But even if all or some of them may have been, on their encountering the earth, members temporarily or permanently of the solar system, we may with considerable probability consider them as having originally entered our system from the interstellar spaces beyond it. Such at least must be our conclusion if we are to admit the unity of the whole class of phenomena of meteorites and falling stars. For, since the orbits of the two best known meteoric streams, those namely of August and November, have been identified with the orbits of two comets, and since in regard to one of these (that of November) Leverrier has shown, with great probability, that as a meteoric cloud it entered and became a member of our system only some 1700 years ago in consequence of the attraction of Uranus, while the August meteoric ring only differs in this respect from it, that it had at a much more remote period found an elliptic orbit round the sun: we are constrained on the assumption with which we started to recognise also in a meteorite a visitor from the regions of remote space. And so far as it goes, the observation by Secchi that the November falling stars exhibit the magnesium lines is in harmony with this view.

It may, however, further be said, that the tendency of scientific conviction is in the direction of recognising the collection towards and concentration in definite centres, of the matter of the universe, as a cosmical law, rather than the opposite supposition of such centres being the sources whence matter is dispersed into space. In the meteorites that fall on our earth (certainly in considerable numbers) we have to acknowledge the evidence of a vast and perpetual movement of space, about which we can only reason as part of a great feature in the universe which we have every ground for not supposing to be confined within the limits of the solar system.

That this matter, whether intercepted or not by the planets and the sun, should to an ever-increasing amount become entangled in the web of solar and planetary attraction, and that the same operation should be collecting round other stars and in distant systems such moving "clouds" of star-dust as have been treated by Schiaparelli, Leverrier, and other astronomers, or individual masses of wandering stone or iron, is a necessary deduction from the view that we have assumed regarding the tendency of cosmical matter to collect towards centres. But in order to trace the previous stages of the history of any meteorite, and, in particular, to determine the conditions under which its present constitution as a rock took its origin, we have only for our guide the actual record written on the meteoric mass itself; and it is in this direction that the mineralogist is now working.

But the progress is necessarily a gradual one. We may indeed assert that the meteorites we know have, probably all of them, been originally formed under conditions from which the presence of water or of free oxygen to the amount requisite to oxidise entirely the elements present were excluded; for this is proved by the nature of the minerals constituting the meteorites and by the way in which the metallic iron is distributed through them.

And one suggestive and significant fact remains to be alluded to; the presence, namely, in some few meteorites of combinations of hydrogen and carbon, with if met with in a terrestrial mineral would with little hesitation be assigned to an organic origin. A few grains were exhibited to the audience of such a body, crystallised from ether, which solvent had extracted it to the amount of about 0·25 per cent from 6 ozs. of the Cold Bokkveldt meteorite.

Similar substances have been extracted by Wöhler, Roscoe, and other chemists from this and other meteorites. It was, however, observed, as pointing to the probability of the comparatively porous meteoric stone having in this case taken up the hydrocarbon as a substance extraneous to it (possibly when in the state of a vapour), that ether extracted it entirely from the solid lumps of the meteorite; pulverisation not in any way adding to the amount obtained, or facilitating in any appreciable degree the separation of the substance.

CHEMICAL PRODUCTS OF EUCALYPTUS.

The valuable character of this plant is becoming more and more appreciated as its properties are better known; and this is more especially the case since its first introduction into Europe from Australia by M. Ramel in 1856. In Southern Europe it is easily acclimatised, though, in districts so far north as Paris, the winter has been found too severe for it. In Australia and Tasmania it is very abundant. Its growth is very rapid; the leaves and the roots have a very great absorbent power for moisture; and this fact, together with the aromatic odour from the leaves, makes the tree peculiarly suitable for marshy and unhealthy districts.

In the *Moniteur Scientifique Quesneville*, M. Papillon discusses the various properties of *Eucalyptus*, and gives the following particulars as to chemical and pharmaceutical preparations obtained from the plant:—

M. Cloëz has studied the chemical properties of *Eucalyptus*. He first sought to know what proportion of essence of *Eucalyptus* could be obtained from the leaves. 10 kilos. of fresh leaves, taken from branches killed by frost in the end of 1867, furnished, on distillation with water, 275 grms. of essence, or 2·75 per cent. 8 kilos. of dry leaves, gathered, after a month, at Hyeres, produced 489 grms. of essence, or a little more than 6 per cent. From leaves that were completely dry, having been brought from Australia five years previously, about 1·5 per cent of essence was obtained.

This essence is a very fluid liquid, slightly coloured, and giving an aromatic odour which reminds one of camphor. Heated in a distilling apparatus, it commences to boil about 170°. The thermometer rises rapidly to 175°, where it remains till about half the product has passed in distillation. Another portion of the essence passes between 188° and 190°. By further application of heat, a small quantity of volatile liquid is obtained at a temperature slightly over 200°.

The liquid distilled between 170° and 178° is not a

pure product. On rectifying with potash and chloride of calcium, a very fluid colourless liquid is obtained, which boils at 175°, and which M. Cloëz calls *Eucalyptol*. It is much lighter than water; its density is 0·905, and it turns the plane of polarisation to the right. It is soluble in alcohol, but only very slightly so in water. Its composition, according to M. Cloëz, is $C_{24}H_{20}O_2$. When treated with nitric acid, one of the products of the reaction is a crystallisable acid, probably analogous to camphoric acid. Another product, obtained by distillation of eucalyptol with phosphoric anhydride in a retort, is *Eucalyptene*, a hydrocarbon with the formula C_2H_{18}. A further product, obtained by the action of phosphoric anhydride, is called by M. Cloëz *Eucalyptolene*.

Besides the essence eucalyptol, to which the *Eucalyptus* largely owes its medicinal properties, it contains a solid, resinous, bitter principle, little known as yet, from which the leaves derive their febrifuge qualities.

The following preparations, &c., are at present manufactured from *Eucalyptus*:—

(1). The essence already spoken of, and which is administered in doses of a few grms. in the form of globules.

(2). Leaf powder, which contains all the active principles of the plant (essence, tannin, bitter principle), and which is prescribed in doses of 4, 8, 12, and even 16 grms. daily.

(3). The infusion and decoction of the leaves. With half a leaf (about 1 grm.) it is possible to aromatise three or four cups, affording a good substitute for tea, employed as a stimulating drink. For topic applications, 8 grms. in decoction, in a litre of water, forms a liquor well charged with the principles indicated.

(4). Water distilled from the leaves, which may be advantageously used with stimulating drinks.

(5). Aqueous extract, alcoholic extract, employed as febrifuges.

(6). Tincture, or alcoholate.

(7). A liquor, which is similar to the liquor of mastic, and a wine, which is a tonic and febrifuge.

(8). Cigars and cigarettes.

Dr. Gimbert has studied, on himself, the effects of essence of *Eucalyptus* when taken into the system. He took various doses of from 10 to 20 drops. He found it had a soothing effect. It diminishes the vascular tension, and the sense of comfort arising from it induces to sleep. A very strong dose produces a temporary excitement, headache, and slight fatigue.

A. B. M.

ASSAY OF PYRITES FOR GOLD.

By J. M. MERRICK, S.B.

The following described method has been employed by myself for more than a year, and found to work well enough to merit description.

One pound, or even 18 ounces (avoirdupois), of fine marble-dust is mixed with 8 ounces of finely-pulverised and sifted pyrites; the whole then re-sifted and put into a Hessian crucible, which should be about one-third filled by the mixture. The crucible is set as usual on a fire-brick, and a fire of hard coal is made around it, the coals being heaped up to within an inch of the top. The crucible is covered with a piece of brick or a piece of sheet-iron. During the first half hour the contents should be stirred once or twice. As the fire grows brisker the carbonic acid evolved keeps the contents of the crucible in brisk ebullition, and the mixture should be stirred well every 5 or 10 minutes. On stirring during this time, the iron rod used seems to meet with but little resistance from the light mass, but at the end of about 1½ hours the evolution of gas suddenly ceases, the red-hot mass becomes heavy, sinks, and requires considerable force to keep it stirred. It must be stirred well and vigorously, however, for about ½ an hour, not leaving it unstirred for more than a minute, otherwise the mass will fuse or cake, and the assay will be almost inevitably ruined.

When a sample taken out in an iron spoon gives off *no* smell of sulphur, the entire contents of the crucible must be turned into a stoneware pot or a wooden bucket half-filled with water, and well stirred. When the powder—which should be uniform and free from lumps or fused pieces—has settled, the water must be poured off, the wet mass allowed to drain, and then transferred to a large earthen bowl or porcelain mortar. Here it is to be amalgamated with about 2 ounces of mercury, to which a little bit of sodium amalgam has been added. The amalgamation, as well as the stirring in the fire, is a tedious process, and one which I prefer to do by proxy. It does not consist in merely grinding with a pestle the mercury in among the particles of the roasted ore, but this ore itself must be ground in contact with the mercury, until the particles are so fine that they will float suspended in water for several seconds. At the end of—say—10 minutes thorough grinding, the contents of the bowl are to be brought into one mass in the bottom of the vessel, the bowl then sunk in a tub of water, and the contents "washed down,"—an operation not easily described, but familiar enough to every old Californian. It consists essentially in shaking the bowl half-full of ore amd water in such a way that the mercury, gold particles, and unground ore sink to the bottom, while the light and finely-ground ore is floated off into the tub. The ore remaining is re-ground and re-washed, and these processes are repeated till nothing but the mercury remains in the bottom of the bowl or mortar. This mercury is then dried with filter-paper, and heated in a porcelain capsule over a Bunsen flame, very gently, until it is sublimed and the gold remains behind. The film of gold may then be scraped up and melted, with a little sodic borate and potassic nitrate, in the very smallest-sized Hessian crucible, either with the foot blowpipe or in a charcoal furnace, by which means a round, clean button of gold, suitable for weighing, will be obtained.

This method—which I have subjected to a most thorough trial, my experiments having been made almost daily for 3½ months—has its disadvantages and its counterbalancing merits. On the one hand, it must be admitted to be tedious, laborious, and to a considerable degree uncertain. Some analysts fail with it altogether, while none who have tried it, so far as I know, get closely agreeing results.

But on the other side, it is certain that this method will indicate the presence of gold, and will bring out the gold in a weighable form from pyritic ores, where the assay by smelting will not show a remote trace of the precious metal; and that where the fire assay shows a certain percentage this will invariably bring out a larger amount. I have obtained large returns by this amalgamation method from iron pyritic ores, which have been repeatedly assayed in the ordinary way, by chemists of great eminence, with uniformly negative results.

It may be added, that while on this side of the water the existence of gold in any workable amount in iron pyrites is strenuously denied by the ablest assayers, the Wicklow pyrites are worked for gold and silver, as by-products to be sure, but in quantities sufficient to pay.

That no gold has been discovered by many assayers in pyritic ores, which have yielded me large results, I refer to the volatility of gold in the presence of sulphur. I imagine that the gold is roasted off in the very first step of the ordinary process. See Crookes and Röhrig's "Metallurgy," "Gold," pp. 629—630, and the authorities there quoted.

I have had no opportunity to put this method in practice on a large scale, and I hardly know what kind of stirring apparatus could be devised; but I have seen 20-lb. lots of ore thus roasted and stirred by hand-power, with satisfactory results.—*American Chemist.*

THE ANALYSIS OF WATERS IN INDIA.*

By EDWARD NICHOLSON, F.C.S.,
Assistant Surgeon R.A., Analyst of Waters, Mysore, Northern and Ceded Districts.

The Fallacy of the New Bengal Method.

Since I last wrote on this subject, a new scheme of water analysis has appeared, in supersession of the Bengal and Madras schemes. This new scheme was compiled by Dr. Macnamara, Chemical Examiner to the Bengal Government, he having been charged, at his own request, with the production of a scheme for general use in India. A uniform scheme was desirable, even if only for the reason that the Bengal and Madras schemes differed essentially; for instance, the Bengal analysts (Dr. Macnamara's first scheme) were required to give chloride of sodium, sulphate of soda, and carbonate of soda as the three "soluble" salts existing in waters, whilst the Madras form (Dr. King's) ordered calcium sulphate, magnesium sulphate, and sodium (as sulphate) to be the three "soluble" salts. Both schemes, however, agreed in three being the number of the "soluble" salts that should be present in waters; *Numero deus impare gaudet.*

The new scheme has judiciously abandoned this artificial method of statement, and has adopted to a great extent the principle of the natural statement I mentioned in my last paper on this subject. It will be remembered that I advised strict adherence to the principle of stating the actual radical substances found in the water, without reference to the processes by which the results were obtained, and relegating to the column of remarks any empirical formula or statement of the combinations in which the radicals were supposed to exist. I showed that, by doing so, uniformity and economy of tabular space was secured, whilst no element of inaccuracy was introduced; processes could be left to the individual skill of analysts, and, if necessary, improvements could be introduced without interference with the form of statement. The whole information could be given in twenty columns.

In the scheme now ordered for adoption, this principle of natural statement has unfortunately been spoiled in practice, as the statement of the quantitative analysis has been mixed up with one (or rather two) of qualitative analysis, besides, of course, the soap test. The resulting forty-six items of information are divided into three portions; the first of these is for use in ordinary cases, and in it only two of the substances found in water (chlorine and sulphuric acid) will be stated, the rest of the report being occupied by the recital of a prolix and inaccurate qualitative examination. The remaining items of the quantitative analysis are reserved (facultatively) for extraordinary occasions; which is to some extent fortunate, as the performance of the analysis *in extenso* would occupy at least a fortnight in a well appointed laboratory; how long it would take when the analyst is working "in such accommodation as a dâk bungalow or spare barrack-room can furnish"† I will not undertake to say.

The following is the detail of the "chemical analysis." I have divided it into three columns, according to the division allowed in the scheme.

I. The part of the examination to be made in all cases.

II. The additional examination to be added under the following conditions:—(1) In the case of any exceptionally important water sources; (2) when the foregoing examination leaves any doubt as to the character of a water; (3) in the case of two water sources of any station, and of a larger number if many water sources have to be examined in any station; (4) in other cases which the Chemical Examiner at that Presidency thinks proper.

III. The further examination to be made at the discretion of the analyst or at the request of the Chemical Examiner of the Presidency.

I.	II.	III.
	Qualitative Analysis.	
	(*a*). Of unconcentrated water.	
1. Reaction.		
2. Free carbonic acid.		
3. Sulphuric acid.		
4. Nitric acid.		
5. Nitrous acid.		
6. Chlorine.		
7. Sulphuretted hydrogen.		
8. Lime.		
9. Iron—ferrous or ferric salt.		
10. Lead, or other heavy metals.		
11. Ammonia.		
	(*b*). Of water concentrated to one quarter of its original bulk.	
1. Reaction.		
2. Nitric acid.		
3. Phosphoric acid.		
4. Silicic acid.		
5. Iron—ferrous or ferric salt.		
6. Magnesia.		
	Quantitative Analysis.	
A. Of suspended matter.		1. Total amount per litre.
		2. Combustible matter per litre.
B. Of dissolved constituents of the water.		
	(*a*). Hardness.	
1. Total.		
2. Removable.		
3. Permanent.		
	(*b*). General Analysis.	
1. Total solids per litre.		
2. Effects of ignition.		
		3. Silicic acid.
		4. Oxide of iron, alumina, phosphoric acid.
	5. Lime.	
	6. Magnesia.	
		7. Alkaline chlorides.
		8. Potassium chloride.
		9. Sodium chloride.
10. Chlorine.		
11. Sulphuric acid.		
		12. Combined carbonic acid.
	13. Nitric acid.	
	14. Nitrous acid.	
		15. Phosphoric acid.
		16. Sulphuretted hydrogen.
	17. Ammonia, free, and of salts.	
	18. Albumenoid ammonia.	
19. Oxygen removed by readily oxidisable matters.		
20. Oxygen removed by oxidisable matters of water heated to 60° C.		
	(*c*). Measurement of gaseous constituents.	
		1. Of nitrogen (corrected for 0° C.) from 1 litre.
		2. Of oxygen.
		3. Of carbonic acid.
		4. Oxygen and nitrogen taken at 100, state proportion of oxygen.

The scheme does not merely give a form of statement for physical and chemical examination; it retains the principle of enforcing certain processes for the determination of the items in the above form, a principle open to objection even if the processes are sound, but most injudicious when, as in the present case, any one of chemical experience can see that the processes are more often bad

* Communicated by the Author.

† The circumstances in view of which this scheme is stated to have been specially devised.

than good. If the analysts are competent for the delicate analytical work involved in measurements of gases, &c., there is no need to lay down rules for them to go by; an analyst of this experience would resent such unnecessary interference, just as the executive medical officer would resent any orders as to the treatment he should adopt in his hospital. If the analysts require to be taught their work, it would be better to place in their hands some respectable manual of analysis, and confine the scheme to an elementary hygienic examination until they shall have learnt by experience.

The processes laid down in this scheme might be useful if they were ordinarily sound, but they unfortunately bear evident traces of being derived, some from books of reference, others neither from books nor from practical experience. It may seem that I am using hard words, but it is no longer time, at the third bad scheme, to deal gently with such grave offences against science.

Taking the second item in the qualitative analysis, I find the following process laid down for the guidance of the analyst.

"*Free Carbonic Acid.*—Pour a little of the water into about 5 c.c. of lime-water contained in a test-tube. If free carbonic acid is present, the precipitate of carbonate of calcium which first forms will re-dissolve on the addition of a large quantity of water."

I thereupon take a rather large-sized test-tube (holding about 30 c.c.). I pour in 5 c.c. of lime-water, and add a little (say 10 c.c.) of the water to be examined. A white precipitate appears, which increases on the addition of more water; the test-tube being full, I continue the experiment in a large beaker; I go on adding the water until I have added half a litre, yet the precipitate does not re-dissolve; by the time I have added a litre the precipitate becomes less perceptible in the large bulk of water, but it has certainly not re-dissolved. Water after water gives the same result. Even a water to which I add 10 per cent of fresh soda-water (sufficient to make it taste distinctly of carbonic acid) fails to produce, in the test-tube, the promised reaction.

The reason is obvious. The 5 c.c. of lime-water contain about 0·50 centigramme of lime ($\frac{1}{100}$); this quantity requires 0·89 centigramme of carbonate of lime, held in solution as bicarbonate, to precipitate it entirely, a reaction which must be accomplished before free carbonic acid can have any re-solvent effect on the precipitated carbonate of lime. Now a water of ordinary calcareous type containing 8·9 centigrammes per litre (6·2 grs. per gallon) would have to be added to the amount of 100 c.c. before the precipitation was complete; and it would require a water to contain no less than 89 centigrammes per litre (62 grs. per gallon) of carbonate of lime for 'a little of the water,' say 10 c.c., to complete the precipitation of the lime contained in 5 c.c. of lime-water. I can find no instance of a potable water containing an amount of carbonate of lime even approaching to this. So we find that a large-sized test-tube will be full long before any free carbonic acid has the slightest chance of re-dissolving the precipitate. When the precipitation is complete, it is doubtful whether it would be re-dissolved by the small amount of free carbonic acid that could be found in a potable water. The author of the scheme has evidently not very clear notions as to what is meant by free carbonic acid; what is often considered as such is not free, being the unstable carbonic acid holding up the carbonate of lime; any excess beyond that necessary for this purpose can only be present in minute quantity; and its detection would certainly not be effected by the process laid down, even were the largest sized vessels substituted for the test-tube ordered to be used.

Passing to the qualitative examination of the concentrated water, the following directions are given:—"About 200 c.c. of the water should be evaporated to one-ourth its bulk, and then tested, as regards its reaction and the presence of nitric acid and iron in the manner already described." The concentrated water is apparently filtered; no direct mention is made of this, but I infer it from the subsequent words: "*Magnesia*—To 10 c.c. of the filtrate," &c. Now I may here observe that the result of the concentration will be to deposit the greater part of the earthy carbonates, perhaps some silicates, and whatever phosphoric acid and iron the water contained. So the analyst on examining the concentrated water will find—(1) that the reaction is alkaline, just as it was before concentration; (2) that the nitric acid is present or absent, just as it was before concentration; (3) that the iron, if present before, has now disappeared, saving him the trouble of ascertaining its condition as a "ferrous or ferric salt." The first two results are of questionable utility, whilst the third will probably be unexpected and productive of some perplexity. The analyst having wasted his time in this manner and searched for magnesia in the filtrate (it is to be hoped that it has not gone all down in the deposit), is directed to proceed as follows:—

"The portion of concentrated water which remains must be tested for phosphoric acid. Add a slight excess of hydrochloric acid, evaporate to dryness in a platinum capsule, and ignite in order to render any silicic acid insoluble. Treat the residue with about 1 c.c. of dilute nitric acid, filter, and mix the filtrate with an equal bulk of solution of molybdate of ammonium and about half the quantity of pure strong nitric acid. If phosphoric acid is present, a yellow crystalline precipitate will form immediately or after a short time."

In the absence of any specific directions, the analyst will naturally take the rest of the filtrate after using some for magnesia, &c.; he will operate as directed on these 20 to 30 c.c. of concentrated water, and after much trouble he will invariably find nothing. Even if he disregarded the instructions and took the precipitate instead of the concentrated water, he would not be much better off; 200 c.c. of water are not nearly sufficient for the detection of the very minute quantity of phosphoric acid usually present in water, and, moreover, the molybdate of ammonia process ordered is one of the most untrustworthy known. However, the certain non-appearance of phosphoric acid in the above-indicated process will be compensated by the probable appearance of platinum; for if the water contain nitrates in at all notable quantity, evaporation with hydrochloric acid will hardly fail to attack the platinum capsule;* so that in the following note: "*Silicic acid*—The residue undissolved by nitric acid may be looked upon as silicic acid," it would perhaps be more correct to read *platinum* for *silicic acid*.

(To be continued.)

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.†

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 55).

Blue Colouring Substances.—Indigo, Orchil, Cudbear, Litmus, Prussian Blue, and Ultramarine.

Indigo.—This most valuable dyeing substance was used as a dye-stuff in India and Egypt long before the Christian era, and the Romans were acquainted with it, although they only used it as a pigment, not knowing how to render it soluble, and so available for dyeing. It is only since the sixteenth century, or from the time of the discovery of the passage to India round the Cape of Good Hope, that it has become generally known in Europe; and its employment as a dye was greatly retarded by the opposition it met with from the large vested interests of the woad cultivators, who induced

* If the nitrous waters of India are thus treated, this accident will occur. I have had a platinum capsule attacked to the extent of half a grain.

† The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

the English, French, and German governments to promulgate several enactments against its use. So severe were some of them, that Henry IV. of France issued an edict, condemning to death any one who used that pernicious drug called the "devil's food." It is only since the year 1737 that the French dyers have had the right of using indigo without restriction.

Indigo exists in several varieties of plants, among which may be mentioned the *Polygonum tinctorium* and the *Isatis tinctoria*, or woad; but, as in the case of nearly all the dye-stuffs already spoken of, it is found most abundantly in plants of the leguminous order. It is extracted commercially from the genus *Indigofera*, varieties of which are cultivated in India, Java, China, and in some of the South American States.

To extract the indigo which the plant contains, it is mowed when in full flower, made into bundles, and carried into large vats containing water. Fermentation ensues, which is allowed to proceed for eight or nine hours, when the liquor, which was yellow at the beginning of the operation, assumes a dark green colour, forming a blue scum on the surface. This liquor is then run off into shallow vats, where it is violently agitated with sticks, stirred by men or women or with a dasher, which produces the same result, the conversion of the white soluble indigo into blue insoluble indigo. A little lime-water is now added, and the whole allowed to rest. The blue indigo thus deposited is boiled with water, when a scum, composed of vegetable and animal matters, comes to the surface, and is removed. The blue paste is thrown on a filter, pressed, and placed in wooden frames, which are divided into small squares, where the indigo is allowed to dry first in the sun and afterwards in the shade. The quality of the indigo produced depends mainly on the care bestowed on its manufacture.

Until 1855 we had no correct ideas as to the state in which the indigo existed in the *Indigofera* plants, nor of the changes which it underwent during the process of extraction. It had been stated by M. Chevreul, many years before, that white indigo was oxidised into blue. But in the above year, and subsequently, in 1857 and 1865, Dr. Schunck published a series of papers, in which he described the true nature of the chemical changes which take place in the manufacture of indigo. He operated on the *Isatis tinctoria*, or woad, which contains the same colour-giving principle as the *Indigofera*. and is the only plant yielding indigo that grows freely in this country.

By these researches, he demonstrated that indigo existed in the plants, combined with a sugar, forming a glucoside, to which he gave the name *indican;* this compound, under the influence of fermentation in the manufacturing process, was unfolded into indigo and sugar. By treating the dried woad with ether or alcohol, Dr. Schunck obtained indican, and, among other processes for its extraction, gives the following simple one. He treats the pounded dried woad leaves with ether in a displacement apparatus, and distils off the greater part of the ether. The remaining green liquor is then evaporated at a moderate temperature, a little cold water added to the syrupy residue, and the insoluble chlorophyl and other matters separated by filtration. The yellow liquid thus obtained is evaporated, either spontaneously or *in vacuo*.

Indican is a yellow, transparent, glutinous solid. As may be seen from the above, it is soluble in alcohol, ether, and water. When boiled with caustic alkalies, it evolves ammonia, but its most remarkable and interesting property is that of yielding indigo blue when treated with strong acids. If sulphuric or muriatic acid be added to its water solution, no change whatever is perceptible for some time. But on heating to near the boiling point, the solution immediately becomes sky-blue. On boiling for a short time, the solution becomes opalescent. On continuing to boil, it acquires a purple colour; and then, provided the solution is tolerably concentrated, a copious deposit of dark purple flocks is formed. These are collected on a filter, and washed with water. By treating the washed flocks with alcohol, Dr. Schunck obtained pure indigotine, and a reddish blue substance was dissolved, called by Berzelius indigo-red, and by Schunck indirubine, which may be considered as a product of the decomposition of indican.

The colour-giving principle of the plant may be considered, like those of the dye-woads, as a glucoside, yielding by its decomposition a colourless principle, which is afterwards converted into a colour. Dr. Schunck explains by the following formula the decomposition of indican into indigo:—

Indican. Water. Indigo. Indiglucine.

$$C_{26}H_{33}NO_{18} + H_2O = C_8H_5NO + 3(C_6H_{10}O_6).$$

In 1864 he published a most valuable paper, throwing much light on the manufacture of indigo, and the management of what is called a woad vat. In it he gives the chemical actions which take place, and explains why, if the indigo manufacturer does not take the greatest care in conducting the process of fermentation, to extract the indigo from the plant, he will either get an inferior quality of indigo, or a great decrease in the yield of the product, or even in some cases entirely lose the colouring matter. He shows that these results take place when the fermentation in the vats is allowed to be either too rapid or too prolonged, in which cases not only is indican decomposed, but the *indiglucine*, or sugar, is converted into alcohol and acetic acid; and he shows that the indigo combines with this alcohol and acetic acid, yielding a compound which does not permit the indigo it contains to be oxidised on exposure to the air. This explains the loss of indigo in its manufacture. Dr. Schunck represents the change by the following formulæ:—

Indigo. Alcohol. Acetic Acid.

$$C_8H_5NO + 8(C_2H_6O) + 3(C_2H_4O_2) + CO_2 = C_{31}H_{39}NO_4 + 13H_2O.$$

He produced this compound more easily by treating pure indigo blue with alcohol, to which was added an alkaline solution of protoxide of tin, until the indigo was dissolved, acetate of soda was then added, and the whole digested at a moderate temperature. The indigo blue after some time ceased to be deposited on exposure to air, having entirely disappeared, having been converted into the new compound.

Pure indigo, or indigotine, can be prepared from indican by the process already described, or by reducing indigo to powder, placing it in a small dish on which is a cover, and applying a heat of about 300° or 400° Fahr., when beautiful prismatic needles of indigotine are sublimed, which are removed mechanically. It is insoluble in water, alcohol, or ether, or in weak acids, or alkalies, but is slightly soluble in creosote, carbolic acid, and anhydrous acetic acid, to which a very small quantity of sulphuric acid has been added. From this latter solution, the indigotine may be precipitated by the addition of water. It is the only solution of blue indigo that can be applied directly on a fabric.

Indigotine, when heated, gives off beautiful violet vapours, having a characteristic odour. Under the action of oxidising agents, such as nitric acid, it yields three distinct products, *isatin*, $C_8H_5N.O_2$; *indigotic or nitro-salycilic* acid $C_7H_3(NO_2)O_3$, and picric acid, $C_6H_{33}(NO_2)O$. The first is formed by simple oxidation, whilst in the second and third, part of the carbon is oxidised, and hyponitric acid is substituted for part of the hydrogen. These chemical reactions lead me to call your attention to some very interesting scientific deductions, showing indigo to bear a very close relation to aniline and carbolic acid, both products derived from coal-tar. If indigotine is heated with potash in a small retort, aniline is produced, and distils over. When indigo is heated for some time with caustic potash solution of specific gravity 1·35, it yields anthranilic acid, which may be considered as a

phenyle-carbamic acid. Anthranilic acid, again, being heated to 570° F., gives salycilic acid, which may be considered as a compound of carbonic with carbolic acid. Lastly, indigotine, like carbolic acid, yields on treatment with excess of nitric acid, picric or trinitrophenic acid.

These facts have produced on the minds of chemists a conviction that indigotine will one day be artificially prepared from carbolic acid, and recently MM. Emmerling and Engler have accomplished the scientific artificial production of indigotine from a compound acetone, discovered in 1857 by M. Friedel, to which these gentlemen have given the name of acetophenone. Their process consists in acting on this compound with fuming nitric acid, when two nitro-compounds are produced, one crystalline, the other syrupy. To the latter, after its evaporation to the state of a resinous mass, they add ten parts of reduced zinc and one part of soda-lime. The mixture is heated in small tubes, when a little water evaporates and a dark-coloured substance sublimes, which contains indigotine in small quantities. This result is certainly a triumph of scientific chemistry, and brings us another stage nearer the commercial artificial production of a most valuable dye.

A great variety of substances, by adding one equivalent of hydrogen, convert blue indigo into white indigo, which is a colourless substance, without taste or odour, insoluble in water, but soluble in alcohol and ether, and in solutions of the alkalies and alkaline earths. On this point I may observe that, many years ago, I devised a process, by which many pounds worth of indigo were recovered from the refuse bottoms of the blue dip vats, the preparation of which I shall explain further on. I found that indigo was susceptible of forming insoluble compounds with the lime and protoxide of iron. White indigo dissolves freely in strong sulphuric acid, giving a dark purple blue liquor.

Many substances are employed commercially to convert blue indigo into the white indigo, soluble in alkalies. Thus, I may mention lime and protoxide of iron, caustic alkali and protoxide of tin, or sulphuret of tin or arsenic, and zinc and caustic alkali; also organic substances, such as grape sugar and bran, which enter easily into fermentation. The following formulæ shows the difference of composition of the two indigos:—

Indigotine. Hydrogen. White Indigo.

$$2(C_8H_5NO) + 2H = C_{16}H_{12}N_2O_2$$

I shall now have the pleasure of proceeding to describe some of the methods employed by chemists to determine the relative commercial value of samples of this expensive dye. The best qualities of indigo from Bengal, Java, and Guatemala are light, have a uniform texture, and a fine coppery hue, which is increased by friction. The following analysis, made by M. Chevreul, shows the composition of a fair sample of commercial indigo:—

Indigotine	45
Matters soluble in alcohol	30
Matters soluble in ether	12
Resin soluble in hydrochloric acid ..	6
Mineral matters	7
	100

Commercial indigos are often adulterated with mineral matters of various kinds. This fraud is easily detected by calcining a known weight of the sample, which ought not to leave a residue of more than 10 per cent. The most common adulteration, however, is the addition of starch. This can be detected by boiling some of the pulverised indigo with a weak solution of hydrochloric acid. The insoluble starch is thus converted into soluble dextrine, which yields a beautiful purple colour with iodine.

There are several processes employed to determine the amount of indigotine in commercial indigos. I shall here only give the outline of three. The first consists in dissolving 1 grm. of the dry pulverised indigo in 12 grms. of concentrated sulphuric acid, and heating the whole at a temperature not exceeding 120° F., when the indigo combines with the sulphuric acid, and becomes perfectly soluble in water. It is then diluted with water, so that the whole occupies one litre. The operation is repeated with 1 grm. of pure indigotine, which serves as a standard of comparison. A solution of bleaching-powder or bichromate of potash—the first proposed by M. Chevreul, the latter by Dr. Penny—is prepared of such a strength that 100 volumes of the solution will completely destroy the whole of the colour produced by the grm. of indigotine. Part of the same liquor is then applied to the solution of the commercial indigo, and the number of volumes required to destroy the colour represents the percentage of indigo. Thus, if 60 divisions are required, it is assumed that there is 60 per cent, if 70 divisions 70 per cent. This method of estimating the indigotine is not to be relied on, as it always gives a much higher percentage of colour-giving principle than exists in the indigo, owing to the hypochlorous acid of the bleaching-powder and the chromic acid of the bichromate not only decomposing the indigotine, but acting on several colouring matters which are included in the portion soluble in alcohol in M. Chevreul's analysis.

The second process gives better results; it is due to Professor Fritzsche, and consists in introducing one part of indigo, finely pulverised, and one part of grape sugar, into 48 or 50 parts of boiling alcohol, to which is added 2 parts of a concentrated solution of caustic soda. The whole is put into a bottle exactly large enough to hold it and left to cool. By exposing the colourless liquid to the atmosphere, the reduced indigo which is in solution absorbs oxygen, and the indigotine is precipitated under the form of beautiful prismatic crystals.

The third process, devised by myself, I have found to give satisfactory results. It consists in introducing into a flask 1 part of finely pulverised indigo, 2 parts of green copperas, and 200 parts of water containing 10 per cent of caustic soda. The whole is kept at the boil for a short time, and allowed to cool. The clear liquor is exposed in shallow vessels to the atmosphere, when the soluble indigo is oxidised, and precipitates as pure indigotine. The residue in the flask is submitted to the treatment three times. The whole of the indigotine thus obtained is collected on a filter, dried, and weighed.

A commercial process, founded on the above method, is carried on by Messrs. Haas and Co., who sell indigo so purified under the name of refined indigo. An inferior quality is also prepared by heating indigo, at a moderate temperature, with weak muriatic acid, which dissolves lime and other mineral matters, as well as any starch it may contain; it is slightly washed and boiled with weak caustic soda, to dissolve the chlorophyl and other resinous impurities.

(To be continued.)

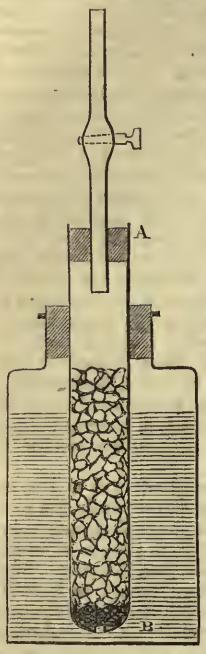
LABORATORY NOTES.

NEW APPARATUS FOR GENERATING H_2S, CO_2, AND H.

NEW forms and new modifications of apparatus are constantly being proposed and described for the convenient generation of H_2S, CO_2, and H in laboratory work. Many of these are somewhat complicated and expensive, more or less difficult to fill, and liable to breakage; as, for instance, the much-used apparatus of Kipp. I think the following simple application of an old principle will be found worthy of trial. The apparatus is cheap and easily made by anybody in a very short time, is easy to move about and to fill, and possesses every advantage of

more complicated ones, as regards being always ready and easy of regulation.

A large wide-necked jar is provided with a well-fitting stopper of cork or caoutchouc. Owing to the difficulty of boring a large hole in caoutchouc, cork will generally be preferred. In this a hole is bored wide enough to take a piece of large-bore glass tube, A B. This tube is of such a length that it reaches almost to the bottom of the jar, and projects two or three inches above the stopper. One end of it, B, is held in the gas-blast, and turned round and round till it softens and partially runs together, leaving only a small opening. The other end is fitted with a caoutchouc stopper, through which passes a glass tube of suitable bore with a glass stopcock, all fitting perfectly tight. The tube reaches a little way below the stopper, and 3 or 4 inches above it, and is connected by india-rubber tube with wash-bottle, &c. The opening at B is covered with lead-shavings, a plug of lead wire, or pieces of glass, to allow the acid to rise into the tube, at the same time preventing any of the bits of marble, zinc, or sulphide of iron falling out. The tube, A B, being filled, is closed by its stopper and stop-cock tube, and inserted through the cork into the jar, which is a little over two-thirds full of the dilute acid. According as the stop-cock is opened, a stream of gas of any required amount is given off, and on closing the cock the acid is all driven into the jar. It is evident that the tube A B must not fit air-tight into the stopper of the jar. The best way of arranging is, after boring the hole in the cork for the tube A B, to cut a little channel with the triangular file, just sufficient to allow of the rise and fall of the liquid in the jar.



A jar about 10 inches high, and proportionately wide, with a tube of 1 to 1¼ inches bore, gives a very suitable apparatus for ordinary use. By using a very large jar, or a large cylinder, and larger and much longer tube, a constant stream may be had for many days.

W. M. Hutchings.

NOTICES OF BOOKS.

Experimental Chemistry, founded on the Work of Dr. Julius Adolph Stöckhardt. A Handbook for the Study of the Science by Simple Experiments. By C. W. Heaton, F.C.S., Professor of Chemistry in the Medical School of Charing Cross Hospital. London: Bell and Daldy. 1872.

There are two methods of studying chemistry, one by *reading* works on chemistry, but only one by which the student can become a chemist, by acquiring facts experimentally. Many handbooks are written merely as exponents of chemical theory, and leave experimental illustration to the care of the professor or teacher. But Mr. Heaton has adopted the true method of imparting a knowledge of chemistry by studying the science by simple experiments. These experiments, however, are not unassisted by theory in its proper place, that of a classification of facts from which laws may be deduced; and theoretical consideration is even extended to include the principles of correlate science with the most happy result. The success of Mr. Heaton's method of teaching is well known, and we cannot do better than refer students to his work. Organic and inorganic chemistry—both are dealt with, every experiment being illustrated with a woodcut showing the disposition of the apparatus employed. The various kinds of chemical formulæ also are admirably explained. Indeed, this may be said to be a perfect manual of elementary chemistry.

The Chemical History and Progress of Aniline Black. By John Lightfoot, Chemist. Published by the Author at Lower House, Burnley, Lancashire. 1871.

Mr. Lightfoot states the object of his pamphlet to be to give to chemists and others connected with dyeing and calico printing the history and progress of aniline black during the past ten years, as well as some curious experiments made with the purpose of determining many debated points of the processes of preparation. Mr. Lightfoot is the inventor and the first to introduce aniline black upon calico, so that the work has importance of the highest order. Inclusive mention is made of many important experiments with aniline black, including the results of the treatment of the prepared cloth with all the metals, scarce, noble, and common, a matter of enormous expenditure. There are many minor experiments of great interest, among which is the following:—An experimental normal colour was printed upon a piece of calico with a wood block, and whilst still wet a shilling and a sovereign, previously cleaned in nitric acid and water, were placed upon the cloth for fifteen minutes; the calico was aged twelve hours and washed, no trace being shown of the contact of the coins. The same coins were then placed in a bag with copper coins, and slightly shaken up with them. Applied then in the same way to the calico, and under the same conditions, the sovereign gave a dark slate, and the shilling an all but black colour. The mere rolling of a copper coin over the wetted calico is sufficient to induce the formation of the black.

We would wish to make a more lengthy extract, but in fairness to the author, who has been at such great expense with the experiments, we must refer to the pamphlet itself for results. To all who have much to do with calico printing the contents will be highly valuable.

CORRESPONDENCE.

WANKLYN AND CHAPMAN'S WATER ANALYSIS.

To the Editor of the Chemical News.

Sir,—Now that the "ammonia process" of Messrs. Wanklyn and Chapman is being generally accepted, it is proper that every phase of the question should be examined. May I therefore, through your columns, call the attention of the authors to two apparently conflicting statements in this little manual of "Water Analysis."

In the first edition, page 48, it is stated that, in distilling water, towards the end of the operation ammonia appears in the distillate, and that this latter portion must be rejected. Now, in estimating the free ammonia in water, it is recommended to distil only about 100 or 200 c.c., and then to add permanganate and proceed with the determination of the albumenoid, NH_3. What becomes of that portion of the ammonia which would be found in the receiver if the distillation had been carried nearly to dryness? Is this amount carried over with the albumenoid NH_3, or is this residual ammonia, as I may call it, merely the result of the decomposition of the nitrogenous matters in the water? Have the authors ever made any experiments to determine the amount of NH_3 which will pass over at the conclusion of the distilla-

tion of ordinary water? I think it but right to call attention to this matter, as I believe that the ammonia method is destined to supersede all others, and that Messrs. Wanklyn and Chapman deserve the thanks of chemists for the ability and perseverance they have displayed. Hoping to gather from your readers some information upon the subject,—I am, &c.,

HENRY LEFFMAN, M.D.

417, Walnut Street, Philadelphia,
July 20, 1872.

ON THE PRESENCE OF ARSENIC IN COLOURED PAPERS.

To the Editor of the Chemical News.

SIR,—The danger arising from the use of arsenical colours in the manufacture of ornaments or toys cannot be over estimated.

The many illustrations given by Dr. Draper show how very common is the use of arsenical greens, on account of their superior brilliancy and stability when exposed to light.

I have found the poison also in a sample of "magenta" tissue paper, which had been used for Christmas decorations. The friend who brought it to me noticed the alliaceous odour peculiar to arsenic when the paper was burnt. It was indeed so strong as to be unmistakable. I could easily detect arsenic by all the ordinary tests. Unfortunately, the sample was thrown aside without any quantitative estimation having been made. The paper must have been coloured with a very crude "magenta." I have not been able to extend the investigation to other articles of the same colour; but I think that the evil arising from the inhalation of minute quantities of arsenic being so great, its use in colours should be entirely prohibited.—I am, &c.,

G. J. WARNER.

Ardwick Bridge Chemical Works,
Manchester, July 29, 1872.

MISCELLANEOUS.

Chemical Appointments.—Dr. W. A. Tilden has been appointed Lecturer on Chemistry at Clifton College; and Mr. Frank Clowes, B.Sc. Lond., F.C.S., has been appointed Science Master at Queenwood College, Hants.

The British Association.—The Brighton meeting will commence on Wednesday, August 14, and continue till Thursday, August 22. On Thursday evening, the 15th, and on Tuesday evening, the 20th, *soirées* will be held. The entire northern block of the Pavilion property is allotted to these—namely, the Dome Assembly Room, the adjoining large building used in the days of the Regent as the Royal riding school, but now converted into a corn-exchange, and the recently-built free library and museum. The exhibition of pictures, articles of vertu, philosophical instruments, and objects of artistic and scientific interest will be very large and varied. The Brighton Natural History Society are arranging a complete flora of the south coast, both living and dried specimens; also a microscopical display, to which the most eminent London makers and the leading metropolitan societies will contribute. It is anticipated that about 400 microscopes will be in use during each *soirée*. On Friday evening, the 16th, and Monday evening, the 19th, lectures will be delivered by leading scientific men. An announcement has been made by the *Athenæum* that whatever information is received from Dr. Livingstone will be communicated at this Brighton meeting of the association. The Town-hall room, designated for the Geographical Section, will hold some 900 people; but it has been suggested that the Livingstone communications should be read in the Dome Assembly-room, which will seat from 2500 to 3000 persons. Four half-day excursions are arranged for Saturday, August 17, and five for Thursday, August 22. In connection with these several county noblemen and gentlemen will display liberal hospitality. The new Brighton Aquarium will be opened and stocked for the meeting of the association. Many invitations have been sent through the Mayor of Brighton, Mr. Cordy Burrows, to Continental and American *savans*, who will attend the meeting as the guests of the municipality. Numerous acceptances have already been received. Working men delegates are also invited from London and the chief centres of industry and manufactures, and a special lecture for working men will be delivered by Mr. W. Spottiswoode, F.R.S. As to the railway arrangements, return tickets will be issued by the Brighton Company to members of the association available from the 12th of August, or any following day, to return by any train and on any day to the 26th of August. Special fortnightly or monthly tickets, at reduced rates, will also be issued to members of the association, available to travel by any train between London and Brighton for the term. The railway company will also allow these fortnightly and monthly tickets to be issued to members of other scientific bodies in London on production of proof of membership. Applications for association tickets and local information should be addressed to the Rev. J. Beck, Secretary of the Local Executive Committee, at the Royal Pavilion, Brighton. The following are the officers elected:—President Elect—Dr. W. B. Carpenter, F.R.S. Vice-Presidents Elect—The Earl of Chichester; the Duke of Norfolk; the Duke of Richmond; the Duke of Devonshire, F.R.S.; Sir John Lubbock, Bart., M.P., F.R.S.; Dr. Sharpey, Sec. R.S.; Mr. Joseph Prestwich, F.R.S., Pres. G. S.—Section A. Mathematical and Physical Science. President—Warren De La Rue, F.R.S. Vice-Presidents—J. Norman Lockyer, F.R.S.; Lord Rosse, F.R.S.; Prof. H. J. Stephen Smith, F.R.S. Secretaries—Prof. W. K. Clifford; R. A. Proctor: A. C. Ranyard. Section B. Chemical Science. President—Dr. J. Hall Gladstone, F.R.S. Vice-Presidents—F. A. Abel, F.R.S.; Professor Williamson, F.R.S. Secretaries—Dr. Mills; W. Chandler Roberts; Dr. W. J. Russell, F.R.S.; T. Wood. Section C. Geology. President—R. A. C. Godwen-Austen, F.R.S. Vice-Presidents—Thomas Davidson, F.R.S.; Prof. P. M. Duncan, F.R.S.; Rev. T. Wiltshire. Secretaries—Henry Woodward; Louis C. Miall; G. Scott; William Topley. Section D. Biology. President—Sir John Lubbock, Bart., M.P., F.R.S. Vice-Presidents—John Ball, F.R.S.; Dr. Beddoe; Prof. Flower, F.R.S; Col. A. Lane Fox; J. Gwyn Jeffreys, F.R.S.; Dr. Burdon Sanderson, F.R.S. Department of Zoology and Botany. Sir John Lubbock, Bart., M.P., will preside. Secretaries—Prof. Thiselton Dyer; H. T. Stainton, F.R.S. Department of Anatomy and Physiology. Dr. Burdon Sanderson, F.R.S., will preside. Secretaries—Dr. Gamgee, F.R.S.; E. Ray Lankester; Dr. Rutherford; Dr. Pye Smith. Department of Anthropology. Col. A. Fox Lane will preside. Secretaries—Dr. Charnock; F. W. Rudler; J. H. Lamprey. Section E. Geography. President—Francis Galton, F.R.S. Vice-Presidents—Clements R. Markham; Major-General Sir Henry Rawlinson, Bart., F.R.S., Pres. R.G.S.; Major-General Strachey, F.R.S. Secretaries—H. W. Bates; A. Keith Johnston; Rev. J. Newton; J. H. Thomas. Section F. Economic Science and Statistics. President—Prof. Henry Fawcett, M.P. Vice-Presidents—R. Dudley Baxter; William Newmarch, F.R.S. Secretaries—J. G. Fitch; Edmund Macrory; Barclay Phillips. Section G. Mechanical Science. President—Frederick J. Bramwell, C.E. Vice-Presidents—John Hawkshaw, F.R.S.; C. W. Merrifield, F.R.S.; Charles B. Vignoles, F.R.S. Secretaries—H. Bauerman; J. Gamble.

Royal College of Science for Ireland.—The following is a copy of the examination paper used by Professor Galloway for the senior students in Practical Chemistry, on June 8th, 1872. *General Instructions.*—The same

value is attached to each determination. Six hours are allowed for the analyses. *Assaying—For the Students in Mining.*—1. Determine the amount of copper in the sample of mine-water given you; each stroke of the pump delivers 33 gallons of this water, there are four strokes a minute, and the pumping is continued night and day. Calculate from your assay how much copper precipitate ought to be produced in twelve months, the copper precipitate containing 56 per cent of copper. 2. Determine by *wet* assay the amount of zinc in the sample of calamine given you, and give the quantity in 1 ton of the ore. 3. Determine by *dry* assay the quantity of lead in the sample of galena given you, and give the quantity in 1 ton of the ore. 4. Determine by *wet* assay the quantity of iron in the sample of hæmatite given you, and state the quantity in 100 parts. *Quantitative Analysis—For the Students in Manufactures.*—1. Estimate the amount of chlorine in the sample of chloride of lime given you, and calculate the quantity in French as well as in English degrees. 2. Determine the amount of free acid and water, and also the amount of chloride of sodium in the sample of salt-cake given you, and give the percentage results. 3. Determine the amount of nitrate of soda in the sample of crude soda-nitrate given you, and state the amount in 100 parts. 4. Determine the amount of copper in the sample of burnt pyrites given you, and state the amount in 20 tons of the burnt ore. *For the Students in Agriculture.*—The percentage amounts of the substances to be determined to be given in each case. 1. Determine the amount of non-volatile matter in the sample of guano given you. 2. Determine the amount of soluble phosphate in the sample of superphosphate given you. 3. Determine in the sample of crude sulphate of ammonia given you the quantity of sulphate of ammonia it contains. 4. Determine the amount of nitrate of soda in the sample of crude soda-nitrate given you.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, July 22, 1872.

This number contains the following original papers and memoirs relating to chemistry, &c.:—

Iron in the Blood of a Non-Vertebrated Animal.—Dr. Boussingault.—This essay contains the record of a series of experiments made by the author with the view of estimating the iron present in the blood of the common garden-snail. The blood, obtained by opening the heart (which, however, only yields one or two drops), is a slightly opalescent fluid, and is nearly colourless; it becomes, by exposure to air, a semi-gelatinous mass; viewed by the microscope, it is found to contain elliptical globules of about the same size as those seen in the blood of cows, and exhibits an alkaline reaction; it contains, in 100 parts—Water, 96·095, and dry substance, 3·905; while the ash amounts to 0·767, and the iron (as metal) to 0·00069. The flesh of the same snails contains, in 100 parts—Water, 84·88, and dry matter, 15·12; while the ash amounts to 3·0 per cent, and the iron (as metal) to 0·001176. 100 parts of the dried snail-blood contain—Iron, 0·0177; and 100 parts of the dried flesh contain—Iron, 0·0078. The blood of oxen contains about ten times more iron than their flesh, while the white blood of the snails contains only about twice the quantity of iron contained in their flesh.

New Process for the Estimation of Ozone.—P. Thenard.—The process is based upon the oxidation of arsenious acid by ozone. A slight excess of a titrated solution of arsenious acid (dissolved in hydrochloric acid) is poured into the bottle containing the ozone, the bottle is then well shaken, and the fluid titrated with permanganate of potassa. The author has purposely tried the effects of nitric, nitrous, and hyponitric acids, and he has found that these substances do not interfere with the correctness of the reaction alluded to, neither does peroxide of hydrogen (oxygenated water). As regards the action of permanganate of potassa upon oxygenated water, the author states that Dr. Brodie's experiments on this subject hold good at the ordinary temperature of the air (then the permanganate is discoloured by the oxygenated water, the disposable oxygen of both being evolved), but the author finds that, when the mixture of the two substances alluded to is cooled by means of a freezing mixture, the oxygen of the permanganate, which becomes discoloured, is retained in the fluid, and remains combined with it as long as the low temperature is applied to the mixture.

New Process of Preserving Food Materials by means of Acetate of Soda.—Dr. Sacc.—This process consists in treating meat and vegetables either with a strong aqueous solution of, or with dry acetate of soda. The substances are left in contact with that salt from twenty-four to forty-eight hours, and then dried. Meat may be placed in a strong solution of the salt alluded to; the brine from the meat is to be evaporated, and is to be added to it when being cooked, in order to restore to it a portion of the salts and extractive matter taken up by the acetate of soda, the preservative action of which seems to depend upon the withdrawal of water from the alimentary substances.

Constitution of Acid Salts while in Solution.—Dr. Berthelot.—Notwithstanding the high scientific merits of this paper, which contains a series of formulæ, its contents are not suited for abstraction; an observation also applicable to the following essay:—

Theory of the Explosion of Detonating Materials.—P. Champion and H. Pellet.

Preparation of Ozone by means of a New Method of Producing an Electric Current.—A. Boillot.—By means of glass tubes coated with coke powder (rendered adhesive to the glass by means of gelatine), a current of galvanic electricity is caused to pass continuously, and without producing sparks, over oxygen, which is thus slowly converted into ozone.

This number contains several important memoirs relating to physiology, meteorology, acoustics, and geology.

July 29, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

Quantity of Iron Contained in the Various Organic and Organised Constituents of the Blood.—Dr. Boussingault.—This memoir contains the detailed account of a series of experiments made with the view to ascertain the quantity of iron (as metal) contained in the various constituents of blood. 100 parts of fibrin contain 2·151 of mineral matter, and 0·0466 metallic iron. 100 parts of the blood-globules contain 1·325 mineral matter, and 0·350 iron. 100 parts of albumen contain 8·715 mineral matter, and 0·0863 iron. 100 parts of human blood contain 0·3 fibrin, 7·0 albumen, 12·7 globules, 1·0 mineral matter, and 79·0 water. 100 parts of cows' blood contain 0·4 fibrin, 7·4 albumen, 10·5 globules, 1·0 mineral matter, 80·7 water. The large quantity of iron met with in the blood-globules is due to the hematosine, which, when separated from defibrinated blood, is of a deep brown colour, insoluble in pure water, but soluble in water which has been rendered slightly alkaline. 100 parts of hematosine contain 10·750 of mineral matter, wherein are 6·33 metallic iron, equal to 9·043 peroxide of iron, leaving 1·707 other mineral matter. Further research exhibited the presence of lime and phosphoric acid in the ash of hematosine, which (the ash) was found to consist, in 100 parts, of 84·121 peroxide of iron, 13·512 phosphoric acid, and 2·986 lime. 100 parts of hematosine consist of 89·25 organic matter, 9·04 peroxide of iron, 1·45 phosphoric acid, and 0·32 lime.

Researches on the Carbon and Soluble Salts Contained in the Ovifak (Greenland) Meteorite.—Dr. Daubrée.—After referring to his former paper on this subject, the author gives an exhaustive account of his researches, more particularly relating to the proportions of free and combined carbon present in the meteorite referred to. The author distinguishes three different types in this mineral; the composition of each of these types is quoted as follows:—

	First Type.		Second Type.		Third Type.	
Metallic iron	40·94	71·09	80·8	82·4	61·99	70·1
Combined iron	30·15		1·6		8·11	
Combined carbon ..	3·00	4·064	2·6	2·9	3·60	4·7
Free carbon	1·64		0·3		1·10	
Silicium	0·75		0·291		Not estimated.	
Water	2·86		0·700		,,	

Chlorides of iron and calcium, soluble in alcohol, were found in the second and third types percentically as follows:—

	Second Type.		Third Type.
	Non-malleable Part.	Malleable Part.	
Chloride of calcium ..	0·455	0·100	0·110
Chloride of iron	0·106	0·098	0·119

As regards the salts soluble in water, the following particulars are given for 100 parts in each type:—

	First Type.	Second Type.	Third Type.
Sulphate of lime	1·288	0·053	0·047
Chloride of calcium ..	0·039	0·233	0·146
Chloride of iron	0·027	0·089	0·114
	1·354	0·375	0·307

Constitution of Acid Salts when in Aqueous Solution.—Dr. Berthelot.—The continuation of a monograph on this subject.

Empyreumatic Hydrocarbons from Péchelbronn (Alsace).—J. A. Le Bel.—The main gist of this paper relates to the methods em-

ployed for separating from each other two iodhydrates of amylen, one of which boils at 130°, and the other at 145°. This separation has been effected by means of hydrochloric acid at the ordinary temperature. In another portion of this memoir the author describes some experiments made with the view of converting hexylen into an iso-alcohol by means of sulphuric acid.

Industrial Preparation of Aniline Colours.—Ch. Girard and G. de Laire.—This paper mainly contains a refutation and correction of statements made and published by M. Lauth affecting the scientific labours of the authors, who affirm that they have not exaggerated the dangers arising from the use of arsenic acid in this branch of industry.

Study on the Gaseous Matter Evolved at Santorin (Italy) during the Volcanic Eruption of 1866.—M. Gorceix.—This memoir, elucidated by several tables exhibiting the results of experiments, is a valuable contribution to our knowledge on the subject of the gaseous matter evolved during volcanic eruptions.

Among the meteorological memoirs contained in this number, we call attention to the following:—

Fall of a Meteorite in the Commune de Lancé, Canton de Saint-Amand (Loir et Cher).—M. de Tastes.—This paper, illustrated by a map delineating the course of the meteorite, contains a detailed and well-authenticated account of the phenomena observed during the fall of this meteorite.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 236, August, 1872.

Report on the Phosphoric Acid and Phosphates Manufactory of Blanchard.—M. Barral.—This exhaustive memoir contains the account of the author's visit to the works alluded to, and already mentioned in the CHEMICAL NEWS, vol. xxvi., pp. 47 and 48. As an appendix to these works, M. Barral has, it appears from a brief note added to this report, established at Pantin (near Paris) a small factory for the purpose of extracting from sewage-water the ammonia it contains, by first adding to that water (heated by means of steam to a temperature of 30° to 35°) milk of lime, and next forcing a current of air through it by means of a blowing-van. The air, charged with ammonia, is made to pass through sulphuric acid, whereby sulphate of ammonia is produced. It appears that this method of eliminating the ammonia is very successful and rapid in action.

Bitumen and its Application to Public Works.—M. Homberg.—An important contribution to our knowledge on asphalte and its applications.

Contrivance for Freezing Water.—E. Carré.—The description, illustrated by a woodcut, of an ice-making machine.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, May 26, 1872.

Testing and Verification of Alcoholometers and Areometers.—M. Collardeau-Vacher.—The continuation and concluding portion of this essay, copiously elucidated by tables and algebraical formulæ.

Newly-Contrived Apparatus for Indicating the Presence of Marsh-Gas in Coal-Pits.—M. Turquan.—The description of a rather complicated apparatus intended for the protection of pitmen from the danger of explosions.

Lacto-Butyrometer.—M. Marchard.—The detailed description, illustrated by woodcuts, of an instrument intended for the purpose of testing the quality of milk and its richness in butter.

Method for Ascertaining the Heating of Portions of Machinery.—Dr. Mayer.—In order to test whether any bearings or parts of machinery become heated by friction, the author proposes to cover the parts with a thin layer of iodide of mercury, as this red-coloured salt becomes black when exposed to a temperature of about 70°.

Gazzetta Chimica Italiana, No. 5, 1872.

This number contains the following original papers and essays:—

Determination of the Molecular Weights of the Saline Substances.—Dr. E. Paterno.—This memoir contains a review of the relation existing between the electrolytical equivalents and the molecular weights of some saline bodies. The author deducts from the researches of Faraday, Matteucci, and Becquerel that the electrolytical equivalents of the salts frequently correspond to their molecular weights; and he further holds that Faraday's law bears upon the decomposition of an equal number of molecules by equally strong electric currents, and that this may be applied to the determination of the molecular weight of the salts, which then are to be formulated, as exhibited in the following instances:—$CuCl_3$ and $CuCl_2$; $HgCl_2$ and Hg_2Cl_2; $SnCl_4$ and $SnCl_2$. For the silver salts—Ag_2O; Ag_2Cl_2; Ag_2SO_4; $Ag_2(NO_3)_2$, $Ag_2NO_3.I$; &c.

Detection of Iodine in Urine in the State of Iodide of Potassium.—C. Gianetti.—This paper contains a critical review of Dr. Pellogio's published memoir "On the Best Means of Detecting Iodine in Urine."

Composition of Candle-Nuts and Kernels and Cake of Cocoa-Nuts.—Dr. G. Nallino.—The first portion of this essay treats on the chemical analysis of the so-called candle-nuts, the seed of the *Aleurites triloba*, Forst., a tree met with in some of the islands of the Pacific Ocean, as well as in the Moluques. The husks of these nuts contain, in 100 parts—Water, 3·71; organic matter, 89·90; mineral matter, 6·39. The kernels contain, in 100 parts—Water, 5·25; fatty matter (extracted by means of sulphide of carbon), 62·97; cellulose and other organic matter, 28·99; mineral matter, 2·79. The quantity of nitrogen amounts to 3·64 per cent. The ash consists, in 100 parts, of—Lime, 18·69; magnesia, 6·02; potassa, 11·33; anhydrous phosphoric acid, 29·33. The second part of this memoir treats on the cocoa-nut cake, used as fodder for cattle after the oil has been pressed from the seed (fruit of *Cocos nucifera*, imported into Europe for extracting the oil it contains, chiefly used for soap making). 100 parts of the air-dry cake contain—Proteine substances, 21·20; fatty matter, 8·60; cellulose, 7·70; water, 9·36. The centesimal composition of the ash of this cake (carbonic acid being deducted) is—Potassa, 40·57; soda, 2·30; lime, 4·71; magnesia, 2·95; peroxide of iron, 3·54; phosphoric acid, 26·98; sulphuric acid, 3·78; silica, 3·38; chlorine, 13·42. The centesimal composition of the kernels of the cocoa-nut in natural state is—Water, 5·80; fatty matter extracted by sulphide of carbon, 67·85; cellulose and other organic matter, 24·80; ash, 1·55.

Annalen der Chemie und Pharmacie, No. 9, 1872.

This number contains the following original papers and memoirs:—

New Derivative of Styphnic Acid.—Dr. J. Schreder.—In the introduction to this paper the author refers at some length to his former researches on the subject of styphnic acid, also known as oxypicric acid, and next treats at length on the action of cyanide of potassium upon the neutral potassa salt of the acid just mentioned. The result of this reaction (the process of preparation and purification of the crude product is described at great length) is the formation of a new body, which has been named resorcin-indophan, a substance soluble in water (the solution exhibiting a blue-violet colouration), insoluble in alcohol and ether, somewhat soluble in boiling-hot acetic acid, and readily so in concentrated sulphuric acid. The formula of this body is $C_9H_4N_4O_6$. The potassa, soda, and baryta salts of this substance are next described, and the essay winds up with a lengthy discussion on the constitutional formula of this body, this portion being elucidated by very lengthy and complex formulæ.

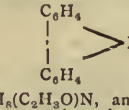
Some Combinations of Vinyl.—Dr. E. Baumann.—This exhaustive monograph is divided into the following sections:—Introduction, containing a condensed review of the labours of Sawitsch, Semenoff, Miasnikoff, and Dr. A. W. Hofmann on this subject; action of sodium methylate upon an excess of iodide and of bromide of vinyl at the ordinary temperature; experiments made with the view to ascertain the action of the cyanides of potassium and of silver upon bromide of vinyl; conversion of the bromide and chloride of vinyl into isomeric bodies.

Camphoric Acid.—F. Wreden.—This essay contains, in the first place, a detailed description of an improved method of preparing camphoric acid; next, a lengthy review of the results of the researches obtained by other scientific chemists who have studied camphoric acid, which is, according to the author, a bibasic acid of the formula $C_8H_{14}(CO_2H)_2$. There exist four isomeric modifications of camphoric acid—viz., dextro- and sinistro-camphoric acids (*i.e.*, optically active); para-camphoric acid, optically inactive; and meso-camphoric acid, discovered by the author, and obtained from the dextro-camphoric acid by the action of hydrochloric or hydriodic acids. The meso-camphoric acid is, in pure state, a solid substance in the form of needle-shaped crystals, is more soluble in water than the other camphoric acids, fuses at 113°, and readily soluble in alcohol and ether. The formula of this acid is $C_{10}H_{16}O_4$. This essay further treats on the substitution-products of camphoric acid anhydride and on amido-camphoric acid, on oxycamphoric acid anhydride (camphanic acid) and on some salts and derivatives from these bodies.

On Carbazol.—C. Graebe and C. Glaser.—Carbazol is a substance met with in crude anthracen, and has been also synthetically prepared by one of the authors by passing vapours of aniline and of diphenyl-amine through red-hot tubes. The preparation of carbazol from the crude material (viz., a heavy coal-tar oil) is described at very great length. In pure state, carbazol is a white-coloured, crystalline, solid substance, fusing at 238°, boiling at 351·5°, insoluble in water, but readily soluble in alcohol, ether, benzol, sulphide of carbon, glacial acetic acid, and chloroform. Carbazol is soluble, without decomposition, in concentrated sulphuric acid, yielding a somewhat yellowish brown-coloured solution, which turns to a deep green colour when the sulphuric acid contains the slightest trace of nitric acid, which strikes with carbazol a green colour. Carbazol forms sulpho- and nitro-compounds and a peculiar combination with picric acid—

$$C_{12}H_9N,C_6H_2(NO_2)_3OH.$$

The formula of carbazol is $C_{12}H_9N$; considered as imido-diphenyl the formula is—



Ethyl-carbazol, $C_{12}H_8(C_2H_3O)N$, and carbazoline, $C_{12}H_{15}N$ (the product of the reaction ensuing when carbazol is heated along with phosphorus and hydriodic acid), are described at length, as is also hydrocarbazol, $C_{12}H_{13}N$.

Vapour Densities of Some Aromatic Compounds of High Boiling-Point.—C. Graebe.—This essay possesses high scientific merits, and it is elucidated by several tables exhibiting results of experiments. Its contents are not, however, suited for useful abstraction.

Les Mondes, August 1, 1872.

This number contains no original matter relating to chemistry or collateral subjects.

Polytechnisches Journal von Dr. E. M. Dingler, first number for July, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

New Form of Noë's Thermo-Electric Element.—A. von Waltenhofen.—The detailed description, illustrated by an engraving, of an improved thermo-electric element suited for therapeutical and other induction apparatus.

Contribution to the Technology of Glass.—E. Siegwart.—This exhaustive essay treats on the history of the discovery of glass, its modes of manufacture, and the present condition of the industry.

Preparation of Thallium on the Large Scale.—M. Schaffner.

Sulpho-Acids of Aniline Blue.—E. Bulk.—This essay treats on —Triphenyl-rosanilin-monosulpho acid (the soda-salt of which is known as Nicholson's blue, or alkali blue; the acid is monobasic); triphenyl-rosanilin-disulpho acid (the soda-salt of this acid is known in practice as soluble blue); triphenyl-rosanilin-trisulpho acid; triphenyl-rosanilin-tetrasulpho acid (the highest sulpho-compound obtainable from aniline blue by the action of sulphuric acid; it is soluble in water, with a blue colour; its alkaline and other salts are readily soluble in water, but insoluble in alcohol). Aniline violet also yields sulpho-acids, but not so readily as aniline blue.

Manufacture of Chili Saltpetre (Nitrate of Soda) and of Iodine at Tarapaca, Peru.—Dr. R. Wagner.—This essay contains statistical figures of the quantities of nitrate of soda obtained daily in eleven of the larger works, the production of which varies from 200 to 1200 cwts. The quantity of iodine met with in 1 litre of the mother-liquors of the works alluded to was found to vary from 2·30 to 4·80 grms.

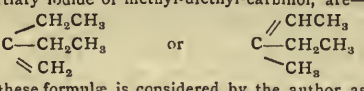
Embalming Composition.—Dr. Bufaline.—For the purpose especially of preserving cadavers for anatomical use, the author recommends the following mixture:—Camphor and pure carbolic acid, each, 70 grms.; paraffin oil, 200 grms. This fluid is either applied by injection into the blood vessels, or the parts of the cadaver to be kept are soaked in it.

The American Journal of Science and Arts, July, 1872.

With the exception of two papers which we reserve for full reproduction, this number contains no original papers relating to chemistry.

Bulletin de l'Academie Imperiale des Sciences de St. Petersbourg, Vol. xvii., No. 4.

New Variety of Hexylen.—N. Tchaikowsky.—After briefly referring to the hexylens discovered and described by Drs. Erlenmeyer, Buff, and Wanklyn, the author states that, starting from methyl-diethyl-carbinol (obtained by causing chloride of acetyl to act upon zinc ethyl), he has converted that alcohol, first into its corresponding iodide, by means of gaseous iodhydric acid, and next this compound has been treated in a sealed tube at 100° with alcoholic caustic potassa solution. Hereby a liquid colourless hydrocarbon was obtained boiling at from 68° to 72°. The vapour density of this body, referred to air, is 2·908; referred to hydrogen, 42·900. The simplest formula is C_6H_{12}; but the constitutional formulæ, which, when combined with hydriodic acid, forms the tertiary iodide of methyl-diethyl-carbinol, are—



The first of these formulæ is considered by the author as the most correct; but further research, and the behaviour of this new hexylen with hypochlorous acid will settle this point.

La Revue Scientifique de la France et de l'Etranger, July 20, 1872.

The Chemical Manures Judged by Tradition.—Dr. G. Ville.—The opening discourse of the experimental lectures on practical agriculture at Vincennes.

July 27, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following physiological essay:—

Chemical Modifications which the Secretions Undergo under the Influence of Substances which Modify the Blood Globules.—Dr. Ritter.

Preis Courant der Fabrik für Alkohol-Präparate, von C. A. F. Kahlbaum, Berlin.

This catalogue of chemical preparations shows rapid advances of manufacturing chemistry in Germany, many rare and complex substances being quoted as regularly prepared. Under the section Methyl-Alcohol, for instance, we meet with methyl-cyanide, trimethylamine, methylen-iodide, and tetrachloride of carbon.

NOTES AND QUERIES.

Glacial Sulphuric Acid.—(Reply to S. R. P.)—This acid may be obtained from Dr. L. O. Marquart, Bonn, at 8 thalers per kilogramme net.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 664.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Brighton Meeting, August 14, 1872.

INAUGURAL ADDRESS OF THE PRESIDENT,

William B. Carpenter, M.D., LL.D., F.R.S.,
Registrar of the University of London.

My Lords, Ladies, and Gentlemen,—

Thirty-six years have now elapsed since at the first and (I regret to say) the only meeting of this Association held in Bristol,—which ancient city followed immediately upon our national universities in giving it a welcome,—I enjoyed the privilege which I hold it one of the most valuable functions of these annual assemblages to bestow; that of coming into personal relation with those distinguished men whose names are to every cultivator of science as "household words," and the light of whose brilliant example, and the warmth of whose cordial encouragement are the most precious influences by which his own aspirations can be fostered and directed. Under the Presidency of the Marquis of Lansdowne, with Conybeare and Prichard as Vice-Presidents, with Vernon Harcourt as General Secretary, and John Phillips as Assistant Secretary, were gathered together Whewell and Peacock, James Forbes and Sir W. Rowan Hamilton, Murchison and Sedgwick, Buckland and De la Beche, Henslow and Daubeny, Roget, Richardson, and Edward Forbes, with many others, perhaps not less distinguished, of whom my own recollection is less vivid.

In his honoured old age, Sedgwick still retains, in the academic home of his life, all his pristine interest in whatever bears on the advance of the science he has adorned as well as enriched; and Phillips still cultivates with all his old enthusiasm the congenial soil to which he has been transplanted. But the rest,—our fathers and elder brothers —"Where are they?" It is for us of the present generation to show that they live in our lives; to carry forward the work which they commenced; and to transmit the influence of their example to our own successors.

There is one of these great men, whose departure from among us since last we met claims a special notice, and whose life—full as it was of years and honours—we should have all desired to see prolonged for a few months, could its feebleness have been unattended with suffering. For we should all then have sympathised with Murchison, in the delight with which he would have received the intelligence of the safety of the friend in whose scientific labours and personal welfare he felt to the last the keenest interest. That this intelligence, which our own expedition for the relief of Livingstone would have obtained (we will hope) a few months later, should have been brought to us through the generosity of one, and the enterprising ability—may I not use our peculiarly English word, the "pluck"—of another of our American brethren, cannot but be a matter of national regret to us. But let us bury that regret in the common joy which both nations feel in the result; and while we give a cordial welcome to Mr. Stanley, let us glory in the prospect now opening, that England and America will co-operate in that noble object which—far more than the discovery of the sources of the Nile—our great traveller has set before himself as his true mission, the extinction of the slave trade.

At the last meeting of this Association, I had the pleasure of being able to announce that I had received from the First Lord of the Admiralty a favourable reply to a representation I had ventured to make to him as to the importance of prosecuting on a more extended scale the course of inquiry into the physical and biological conditions of the deep sea, on which, with my colleagues, Professor Wyville Thomson and Mr. J. Gwyn Jeffries, I had been engaged for the three preceding years. That for which I had asked was a circumnavigating Expedition of at least three years' duration, provided with an adequate scientific staff, and with the most complete equipment that our experience could devise. The Council of the Royal Society having been led by the encouraging tenor of the answer I had received, to make a formal application to this effect, the liberal arrangements of the Government have been carried out under the advice of a scientific committee which included representatives of this Association. H.M.S. *Challenger*, a vessel in every way suitable for the purpose, is now being fitted out at Sheerness; the command of the Expedition is entrusted to Captain Nares, an officer of whose high qualifications I have myself the fullest assurance; while the scientific charge of it will be taken by my excellent friend Professor Wyville Thomson, at whose suggestion it was that these investigations were originally commenced, and whose zeal for the efficient prosecution of them is shown by his relinquishment for a time of the important academic position he at present fills. It is anticipated that the Expedition will sail in November next; and I feel sure that the good wishes of all of you will go along with it.

The confident anticipation expressed by my predecessor that, for the utilisation of the total eclipse of the sun then impending, our Government would "exercise the same wise liberality as heretofore in the interests of science," has been amply fulfilled. An Eclipse Expedition to India was organised at the charge of the Home Government, and placed under the direction of Mr. Lockyer; the Indian Government contributed its quota to the work; and a most valuable body of results was obtained, of which, with those of the previous year, a report is now being prepared under the direction of the Council of the Astronomical Society.

It has been customary with successive occupants of this chair, distinguished as leaders in their several divisions of the noble army of science, to open the proceedings of the meetings over which they respectively presided with a discourse on some aspect of Nature in her relation to man. But I am not aware that any one of them has taken up the other side of the enquiry,—that which concerns man as the "interpreter of Nature;" and I have therefore thought it not inappropriate to lead you to the consideration of the mental processes by which are formed those fundamental conceptions of matter and force, of cause and effect, of law and order, which furnish the basis of all scientific reasoning, and constitute the *philosophia prima* of Bacon. There is a great deal of what I cannot but regard as fallacious and misleading philosophy—"oppositions of science falsely so-called"—abroad in the world at the present time. And I hope to satisfy you that those who set up *their own conceptions* of the orderly sequence which they discern in the phenomena of nature as fixed and determinate *laws*, by which those phenomena not only *are* within all human experience, but always *have been*, and always *must be*, invariably governed, are really guilty of the intellectual arrogance they condemn in the systems of the ancients, and place themselves in diametrical antagonism to those real philosophers, by whose comprehensive grasp and penetrating insight that order has been so far disclosed. For what love of the truth as it is in nature was ever more conspicuous than that which Kepler displayed, in his abandonment of each of the ingenious conceptions of the planetary system which his

fertile imagination had successively devised, so soon as it proved to be inconsistent with the facts disclosed by observation? In that almost admiring description of the way in which his enemy Mars, "whom he hsd left at home a despised captive," had "burst all the chains of the equations, and broke forth from the prisons of the tables," who does not recognise the justice of Schiller's definition of the real philosopher as one who always loves truth better than his system? And when at last he had gained the full assurance of a success so complete that (as he says) he thought he must be dreaming, or that he had been reasoning in a circle, who does not feel the almost sublimity of the self-abnegation with which, after attaining what was in his own estimation such a glorious reward of his life of toil, disappointment, and self-sacrifice, he abstains from claiming the applause of his contemporaries, but leaves his fame to after ages in these noble words: "The book is written; to be read either now or by posterity, I care not which. It may well wait a century for a reader, as God has waited six thousand years for an observer."

And when a yet greater than Kepler was bringing to its final issue that grandest of all scientific conceptions, long pondered over by his almost superhuman intellect,—which linked together the heavens and the earth, the planets and the sun, the primaries and their satellites, and included even the vagrant comets, in the *nexus* of a universal attraction—establishing for all time the truth for whose utterance Galileo had been condemned, and giving to Kepler's laws a significance of which their author had never dreamed,—what was the meaning of that agitation which prevented the philosopher from completing his computation, and compelled him to hand it over to his friend? That it was not the thought of his own greatness, but the glimpse of the grand universal order thus revealed to his mental vision, which shook the serene and massive soul of Newton to its foundations, we have the proof in that beautiful comparison in which he likened himself to a child picking up shells on the shore of the vast ocean of truth—a comparison which will be evidence to all time at once of his true philosophy and his profound humility.

Though it is with the intellectual representation of nature which we call *Science*, that we are primarily concerned, it will not be without its use to cast a glance in the first instance at the other two principal characters under which man acts as her interpreter,—those, namely, of the artist and of the poet.

The artist serves as the interpreter of Nature, not when he works as the mere copyist, delineating that which he sees with his bodily eyes, and which we could see as well for ourselves; but when he endeavours to awaken within us the perception of those beauties and harmonies which his own trained sense has recognised, and thus impart to us the pleasure he has himself derived from their contemplation. As no two artists agree in the original constitution and acquired habits of their minds, all look at Nature with different (mental) eyes; so that to each, *Nature is what he individually sees in her.*

The poet, again, serves as the interpreter of Nature, not so much when by skilful word-painting (whether in prose or verse) he calls up before our mental vision the picture of some actual or ideal scene, however beautiful; as when, by rendering into appropriate forms those deeper impressions made by the nature around him on the moral and emotional part of his own nature, he transfers these impressions to the corresponding part of ours. For it is the attribute of the true poet to penetrate the secret of those mysterious influences which we all unknowingly experience; and having discovered this to himself, to bring others, by the power he thus wields, into the like sympathetic relation with Nature,—evoking with skilful touch the varied response of the soul's finest chords, heightening its joys, assuaging its griefs, and elevating its aspirations. Whilst, then, the artist aims to picture what he *sees* in Nature, it is the object of the poet to represent what he *feels* in Nature; and to each true poet, *Nature is what he individually finds in her.*

The philosopher's interpretation of Nature *seems* less individual than that of the artist or the poet, because it is based on facts which anyone may verify, and is elaborated by reasoning processes of which all admit the validity. He looks at the Universe as a vast book lying open before him, of which he has in the first place to learn the characters, then to master the language, and finally to apprehend the ideas which that language conveys. In that book there are many chapters, treating of different subjects; and as life is too short for any one man to grasp the whole, the scientific interpretation of this book comes to be the work of many intellects, differing not merely in the range but also in the character of their powers. But whilst there are "diversities of gifts," there is "the same spirit." While each takes his special direction, the general method of study is the same for all. And it is a testimony alike to the truth of that method and to the unity of Nature, that there is an ever-increasing tendency towards agreement among those who use it aright;—temporary differences of interpretation being removed, sometimes by a more complete mastery of her language, sometimes by a better apprehension of her ideas;—and lines of pursuit which had seemed entirely distinct, or even widely divergent, being found to lead at last to one common goal. And it is this agreement which gives rise to the general belief—in many, to the confident assurance—that the scientific interpretation of Nature represents her not merely as she *seems*, but as she *really is*.

When, however, we carefully examine the foundation of that assurance, we find reason to distrust its security; for it can be shown to be no less true of the scientific conception of nature, than it is of the artistic or the poetic, that it is *a representation framed by the mind itself* out of the materials supplied by the impressions which external objects make upon the senses; so that to each man of science, *nature is what he individually believes her to be.* And that belief will rest on very different bases, and will have very unequal values, in different departments of science. Thus in what are commonly known as the "exact" sciences, of which astronomy may be taken as the type, the data afforded by precise methods of observation can be made the basis of reasoning, in every step of which the mathematician feels the fullest assurance of certainty; and the final deduction is justified either by its conformity to known or ascertainable facts,—as when Kepler determined the elliptic orbit of Mars; or by the fulfilment of the predictions it has sanctioned,—as in the occurrence of an eclipse or an occultation at the precise moment specified many years previously; or, still more emphatically, by the actual discovery of the phenomena till then unrecognised,—as when the perturbations of the planets, shown by Newton to be the necessary results of their mutual attraction, were proved by observation to have a real existence; or as when then the unknown disturber of Uranus was found in the place assigned to him by the computations of Adams and Le Verrier.

We are accustomed, and I think most rightly, to speak of these achievements as triumphs of the human intellect. But the very phase implies that the work is done by mental agency; and the coincidence of its results with the facts of observation is far from proving the intellectual process to have been correct. For we learn from the honest confessions of Kepler, that he was led to the discovery of the elliptic orbit of Mars by a series of happy accidents, which turned his erroneous guesses into the right direction; and to that of the passage of the Radius Vector over *equal areas in equal times*, by the notion of a whirling force emanating from the sun, which we now regard as an entirely wrong conception of the cause of orbital revolution.* It should always be remembered, moreover, that the Ptolemaic system of astronomy, with all its cumbrous ideal mechanism of "Centric and Excentric, Cycle and

* See Drinkwater's "Life of Kepler," in the Library of Useful Knowledge, pp. 26 to 35.

Epicycle, Orb in Orb," did intellectually represent all that the astronomer, prior to the invention of the telescope, could see from his actual standpoint, the earth, with an accuracy which was proved by the fulfilment of his anticipations. And in that last and most memorable prediction which has given an imperishable fame to our two illustrious contemporaries, the inadequacy of the basis afforded by actual observation of the perturbations of Uranus, required that it should be supplemented by an assumption of the probable distance of the disturbing planet beyond, which has been shown by subsequent observation to have been only an approximation to the truth.

Even in this most exact of sciences, therefore, we cannot proceed a step, without translating the actual phenomena of nature into intellectual representations of those phenomena; and it is because the Newtonian conception is not only the most simple, but is also, up to the extent of our present knowledge, *universal* in its conformity to the facts of observation, that we accept it as the only scheme of the universe yet promulgated which satisfies our intellectual requirements.

When, under the reign of the Ptolemaic System, any new inequality was discovered in the motion of a planet, a new wheel had to be added to the ideal mechanism,—as Ptolemy said, "to save appearances." If it should prove, a century hence, that the motion of Neptune himself is disturbed by some other attraction than that exerted by the interior planets, we should confidently expect that not an *ideal* but a *real* cause for that disturbance will be found in the existence of another planet beyond. But I trust that I have now made it evident to you, that this confident expectation is not justified by any absolute necessity of Nature, but arises entirely out of *our belief* in her uniformity; and into the grounds of this and other primary beliefs, which serve as the foundation of all scientific reasoning, we shall presently inquire.

There is another class of cases, in which an equal certainty is generally claimed for conclusions that seem to flow immediately from observed facts, though really evolved by intellectual processes; the apparent simplicity and directness of those processes either causing them to be entirely overlooked or veiling the assumptions on which they are based. Thus Mr. Lockyer speaks as confidently of the sun's chromosphere of incandescent hydrogen, and of the local outbursts which cause it to send forth projections tens of thousands of miles high, as if he had been able to capture a flask of this gas, and had generated water by causing it to unite with oxygen. Yet this confidence is entirely based on the assumption, that a certain line which is seen in the spectrum of a hydrogen flame, *means* hydrogen also when seen in the spectrum of the sun's chromosphere; and high as is the probability of that assumption, it cannot be regarded as a demonstrated certainty, since it is by no means inconceivable that the same line *might* be produced by *some other* substance at present unknown. And so when Dr. Huggins deduces from the different relative positions of certain lines in the spectra of different stars that these stars are moving from or towards us in space, his admirable train of reasoning is based on the assumption that these lines have *the same meaning*—that is, that they *represent the same elements*—in every luminary. That assumption, like the preceding, may be regarded as possessing a sufficiently high probability to justify the reasoning based upon it; more especially since, by the other researches of that excellent observer, the same chemical elements have been detected as vapours in those filmy cloudlets which seem to be stars in an early stage of consolidation. But when Frankland and Lockyer, seeing in the spectrum of the yellow solar prominences a certain bright line not identifiable with that of any known terrestrial flame, attribute this to a hypothetical new substance which they propose to call Helium, it is obvious that their assumption rests on a far less secure foundation; until it shall have received that verification, which, in the case of Mr. Crookes's researches on Thallium, was afforded by the actual discovery of the new metal, whose presence had been indicated to him by a line in the spectrum not attributable to any substance then known.

In a large number of other cases, moreover, our scientific interpretations are clearly matters of *judgment*; and this is eminently a *personal act*, the value of its results depending in each case upon the qualifications of the *individual* for arriving at a correct decision. The surest of such judgments are those dictated by what we term "common sense," as to matters on which there seems no room for difference of opinion, because every sane person comes to the same conclusion, although he may be able to give no other reason for it than that it appears to him "self-evident." Thus while philosophers have raised a thick cloud of dust in the discussion of the basis of our belief in the existence of a world external to ourselves,—of the Non Ego, as distinct from the Ego,—and while every logician claims to have found some flaw in the proof advanced by every other,—the common sense of mankind has arrived at a decision that is practically worth all the arguments of all the philosophers who have fought again and again over this battle-ground. And I think it can be shown that the trustworthiness of this common sense decision arises from its dependence, not on any one set of experiences, but upon *our unconscious co-ordination of the whole aggregate of our experiences*,—not on the conclusiveness of any one train of reasoning, but on *the convergence of all our lines of thought towards this one centre*.

Now this "common sense," disciplined and enlarged by appropriate culture, becomes one of our most valuable instruments of scientific inquiry; affording in many instances the best, and sometimes the only, basis for a rational conclusion. Let us take as a typical case, in which no special knowledge is required, what we are accustomed to call the "flint implements" of the Abbeville and Amiens gravel-beds. No logical proof can be adduced that the peculiar shapes of these flints were given to them by human hands; but does any unprejudiced person now doubt it? The evidence of *design*, to which, after an examination of one or two such specimens, we should only be justified in attaching a probable value, derives an irresistible cogency from accumulation. On the other hand, the *im*probability that these flints acquired their peculiar shape by *accident*, becomes to our minds greater and greater as more and more such specimens are found; until at last this hypothesis, although it cannot be directly disproved, is felt to be almost inconceivable, except by minds previously "possessed" by the "dominant idea" of the modern origin of man. And thus what was in the first instance a matter of discussion, has now become one of those "self-evident" propositions, which claim the unhesitating assent of all whose opinion on the subject is entitled to the least weight.

We proceed upwards, however, from such questions as the common sense of mankind generally is competent to decide, to those in which special knowledge is required to give value to the judgment; and thus the interpretation of Nature by the use of that faculty comes to be more and more *individual*; things being perfectly "self-evident" to men of special culture which ordinary men, or men whose training has lain in a different direction, do not apprehend as such. Of all departments of science, geology seems to me to be the one that most depends on this specially-trained "common sense;" which brings as it were into one focus the light afforded by a great variety of studies,—Physical and Chemical, Geographical and Biological; and throws it on the pages of that Great Stone Book, on which the past history of our globe is recorded. And whilst astronomy is of all sciences that which may be considered as most nearly representing Nature as she really is, geology is that which most completely represents her as seen through the medium of the interpreting mind; the meaning of the phenomena that constitute its data being in almost every instance open to question, and the judgments passed upon the

same facts being often different according to the qualifications of the several judges. No one who has even a general acquaintance with the history of this department of science, can fail to see that the geology of each epoch has been the reflection of the minds by which its study was then directed; and that its true progress dates from the time when that "common sense" method of interpretation came to be *generally* adopted, which consists in seeking the explanation of past changes in the forces at present in operation, instead of invoking the aid of extraordinary and mysterious agencies, as the older geologists were wont to do, whenever they wanted—like the Ptolemaic astronomers—"to save appearances." The whole tendency of the ever-widening range of modern geological inquiry has been to show how little reliance can be placed upon the so-called "laws" of stratigraphical and palæontological succession, and how much allowance has to be made for local conditions. So that while the astronomer is constantly enabled to point to the fulfilment of his predictons as an evidence of the correctness of his method, the geologist is almost entirely destitute of any such means of verification. For the value of any prediction that he may hazard—as in regard to the existence or non-existence of coal in any given area,—depends not only upon the truth of the general doctrines of geology in regard to the succession of stratified deposits, but still more upon the detailed knowledge which he may have acquired of the distribution of those deposits in the particular locality. Hence no reasonably-judging man would discredit either the general doctrines or the methods of geology, because the prediction proves untrue in such a case as that now about to be brought in this neighbourhood to the trial of experience.

We have thus considered man's function as the scientific interpreter of Nature in two departments of natural knowledge; one of which affords an example of the strictest, and the other of the freest method, which man can employ in constructing his intellectual representation of the universe. And as it would be found that in the study of all other departments the same methods are used, either separately or in combination, we may pass at once to the other side of our inquiry,—namely the origin of those primary beliefs which constitute the groundwork of all scientific reasoning.

The whole fabric of geometry rests upon certain axioms which every one accepts as true, but of which it is necessary that the truth should be *assumed*, because they are incapable of demonstration. So, too, the deliverances of our "common sense" derive their trustworthiness from what we consider the "self-evidence" of the propositions affirmed.

This inquiry brings us face to face with one of the great philosophical problems of our day, which has been discussed by logicians and metaphysicians of the very highest ability as leaders of opposing schools, with the one result of showing how much can be said on each side. By the *Intuitionalists* it is asserted that the tendency to form these primary beliefs is inborn in man, an original part of his mental organisation; so that they grow up spontaneously in his mind as its faculties are gradually unfolded and developed, requiring no other experience for their genesis than that which suffices to call these faculties into exercise. But by the advocates of the doctrine which regards *experience* as the basis of all our knowledge, it is maintained that the primary beliefs of each individual are nothing else than generalisations which he forms of such experiences as he has either himself acquired or has consciously learned from others; and they deny that there is any original or intuitive tendency to the formation of such beliefs beyond that which consists in the power of retaining and generalising experiences.

I have not introduced this subject with any idea of placing before you even a summary of the ingenious arguments by which these opposing doctrines have been respectively supported; nor should I have touched on the question at all, if I did not believe that a means of reconcilement between them can be found in the idea, that *the intellectual intuitions of any one generation are the embodied experiences of the previous race.* For, as it appears to me, there has been a progressive improvement in the *thinking power* of man; every product of the culture which has preceded serving to prepare the soil for yet more abundant harvest in the future.

Now, as there can be no doubt of the hereditary transmission in man of acquired constitutional peculiarities, which manifest themselves alike in tendencies to bodily and to mental disease, so it seems equally certain that *acquired mental habitudes* often impress themselves on his organisation, with sufficient force and permanence to occasion their transmisson to the offspring as *tendencies to similar modes of thought.* And thus, while all admit that *knowledge* cannot thus descend from one generation to another, an increased *aptitude* for the acquirement, either of knowlede generally, or of some particular kind of it, may be thus inherited. These tendencies and aptitudes will acquire additional strength, expansion, and permanence in each new generation, from their habitual exercise upon the materials supplied by a continually enlarged experience; and thus the *acquired* habitudes produced by the intellectual culture of ages will become a "second nature" to every one who inherits them.*

We have an illustration of this progress in the fact of continual occurrence, that conceptions which prove inadmissible to the minds of one generation, in consequence either of their want of intellectual power to apprehend them, or of their preoccupation by older habits of thought, subsequently find a universal acceptance, and even come to be approved as "self-evident." Thus the first law of motion divined by the genius of Newton, though opposed by many philosophers of his time as contrary to all experience, is now accepted by common consent, not merely as a legitimate inference from experiment, but as the expression of a necessary and universal truth; and the same axiomatic value is extended to the still more general doctrine, that energy of *any* kind, whether manifested in the "molar" motion of masses, or consisting in the "molecular" motion of atoms, *must* continue under some form or other without abatement or decay; what all admit in regard to the indestructibility of matter, being accepted as no less true of force, namely, that as *ex nihilo nil fit*, so *nil fit ad nihilum.*†

But, it may be urged, the very conception of these and similar great truths is in itself a typical example of intuition. The men who divined and enunciated them stand out above their fellows, as possessed of a genius which could not only combine, but create, of an insight which could clearly discern what reason could but dimly shadow forth. Granting this freely, I think it may be shown that the intuitions of individual genius are but specially exalted forms of endowments which are the general property of the race at the time, and which have come to be so in virtue of its whole previous culture.

* I am glad to be able to append the following extract from a letter which Mr. John Mill, the great master of the experimental school, was good enough to write to me a few months since, with reference to the attempt I had made to place "common sense" upon this basis (*Contemporary Review*, Feb., 1872) :—"When states of mind in no respect innate or instinctive have been frequently repeated, the mind acquires, as is proved by the power of habit, a greatly increased facility of passing into those states; and this increased facility must be owing to some change of a physical character in the organic action of the brain. There is also considerable evidence that such acquired facilities of passing into certain modes of cerebral action can in many cases be transmitted, more or less completely, by inheritance. The limits of this power of transmission, and the conditions on which it depends, are a subject now fairly before the scientific world; and we shall doubtless in time know much more about them than we do now. But so far as my imperfect knowledge of the subject qualifies me to have an opinion, I take much the same view of it that you do, at least in principle."

† This is the form in which the doctrine now known as that of the "conservation of energy" was enunciated by Dr. Mayer, in the very remarkable essay published by him in 1845, entitled "Die Organische Bewegung in ihrem Zusammenhange mit dem Stoffwechsel."

Who, for example, could refuse to the marvellous aptitude for perceiving the relations of numbers, which displayed itself in the untutored boyhood of George Bidder and Zerah Colburn, the title of an intuitive gift? But who, on the other hand, can believe that a Bidder or a Colburn could suddenly arise in a race of savages who cannot count beyond five? Or, again, in the history of the very earliest years of Mozart, who can fail to recognise the dawn of that glorious genius, whose brilliant but brief career left its imperishable impress on the art it enriched? But who would be bold enough to affirm that an infant Mozart could be born amongst a tribe whose only musical instrument is a tom-tom, whose only song is a monotonous chant?

Again, by tracing the gradual *genesis* of some of those ideas which we now accept as "self-evident"—such, for example, as that of the "uniformity of nature"—we are able to recognise them as the expressions of certain intellectual tendencies, which have progressively augmented in force in successive generations, and now manifest themselves as mental instincts that penetrate and direct our ordinary course of thought. Such instincts constitute a precious heritage, which has been transmitted to us with ever increasing value through the long succession of preceding generations; and which it is for us to transmit to those who shall come after us, with all that further increase which our higher culture and wider range of knowledge can impart.

(To be continued.)

Section B.

ADDRESS
TO THE
CHEMICAL SECTION.

August 15, 1872.

By J. H. GLADSTONE, Ph.D., F.R.S.,
President of the Section.

Gentlemen,—

One of my fellow-students in the laboratory of the late Professor Graham began the study of chemistry because he wanted to be a geologist, and he had read in some geological catechism that, in order to be versed in that science, it was necessary, as a preliminary step, to gain a knowledge of chemistry, mineralogy, zoology, botany, and I know not what besides. My friend became a chemist, and found that enough for the exercise of his faculties. Yet the catechism had truth on its side; for so intertwined are the various branches of observational or experimental research, that a perfect understanding of one can only be obtained through an acquaintance with the whole cycle of knowledge.

Yet, on the other hand, who can survey the whole field even of modern chemistry? There was a time doubtless in the recollection of the more venerable of my auditors, when it was not impossible to learn all that chemists had to teach; but now that our "Hand-book" has grown so large that it would take a Briareus to carry it, and it requires a small army of abstractors to give the Chemical Society the substance of what is done abroad, we are compelled to become specialists in spite of ourselves. He who studies the general laws of chemistry may well turn in despair from the ever-growing myriads of transformations among the compounds of carbon; we have agricultural, physiological, and technical chemists; one man builds up new substances, another new formulæ; while some love the rarer metals, and others find their whole soul engrossed by the phenyl compounds.

How is this necessity of specialisation to be reconciled with the necessity of general knowledge? By our forming a home for ourselves in some particular region, and becoming intimately conversant with every feature of the locality and their choicest associations, while at the same time we learn the general map of the country, so as to know the relative position and importance of our favourite resort, and to be able—when we desire it—to make excursions elsewhere.

To facilitate this is one of the great objects of the British Association. The different Sections are like different countries, and leaving the insular seclusion of our special studies we can pass from one to the other, and gain the advantages of foreign travel.

From this Chair I must of course regard chemistry as the centre of the universe; and in speaking of other Sections I must think of them only in their relation to ourselves. There is that rich and ancient country, Section A, which, according to the Annual Report, comprises several provinces, Mathematics, Astronomy, Optics, Heat, Electricity, and Meteorology.

Mathematics and Astronomy.—It was when the idea of exact weights and measures was projected into it that alchemy was transmuted into chemistry: as our science has become more refined in its methods its numerical laws have become more and more significant, and it may safely be predicted that the more closely it is allied with general physics, the greater will be the mathematical knowledge demanded of its votary. But till lately the chemist and the astronomer seemed far asunder as the heavens and the earth, and none could have foretold that we should now be analysing the atmospheres of the sun and stars, or throwing light on the chemical composition of planetary nebulæ and the heads of comets. There is in this, too, as in other things, a reciprocal benefit; for we are encouraged to hope that this celestial chemistry will reveal to us elements which have not yet been detected among the constituents of our globe.

Light, Heat, and Electricity.—How intimately are these associated with the chemical force, or rather how easily are these Protean forces transformed into one another! The rays of the sun coming upon our earth are like a chemist entering his laboratory; they start strange decompositions and combinations not only in the vegetable kingdom, but also among inorganic gases and salts; they are absorbed selectively by different bodies which they penetrate, or are refracted, dispersed, and polarised according to the chemical composition and structure of the substance. All this has been the subject recently of much scientific research; and I need scarcely remind you of the beautiful art of photography as one of the results of photo-chemistry, or of the benefits that have arisen from a study of circular polarisation, indices of refraction, and especially spectrum analysis. In regard to the latter, however, I would remark that while the optical examination of the rays emitted by luminous vapours has yielded most brilliant results, there is another kind of spectrum analysis—that of the rays absorbed by various terrestrial gases, liquids, and solids—which has already borne valuable fruit, and which, as it is far more extensively applicable than the other, may perhaps play a still more important part in the chemistry of the future. The dispersion of the rays of the spectrum is certainly due to the chemical nature of the body through which they pass; but this is as yet almost unbroken ground waiting for an explorer. As to heat, it has ever been the tool of the chemist; and it would be difficult to overestimate the significance of researches into the specific heat, or the melting- and boiling-points of elements and their compounds. The laws of chemical combination have been elucidated lately by thermo-chemical researches; it has been sought to establish a connexion between the absorption or radiation of heat and the complexity of the chemical constitution of the active body; while the power of conducting heat, or of expanding under its influence, offers a promising field of inquiry. As to electrical science, one department of it—galvanism—is

strictly chemical; the electrolytic cell does our work; and indeed we claim half the electric telegraph, for while the needle may oscillate in Section A, the battery belongs to B.

Last in Section A comes meteorology; and there are chemical questions concerning the constitution of the atmosphere, its changes, and the effect of its occasional constituents upon vegetable and animal life, which merit the deepest attention of the physiologist, philanthropist, and statesman.

If we turn to Section C, there is an outlying province belonging to us, namely, mineralogy, which lies on the frontiers of geology. A vast and very promising region is the origin and mode of formation of different minerals: this has attracted some explorers during the past year; but in order to investigate it properly the geologist and the chemist must travel hand in hand. Geology, in demanding of us the analysis of earths and ores, rocks and precious stones, repays us by bringing to our knowledge many a rare element and strange combination.

When we pass from C to D, that is from the crust of the globe to the organised beings that inhabit and adorn it, we are introduced into new regions of research. When organic chemistry was young, Cuvier said of it, "Dans cette nouvelle magie, le chimiste n'a presque qu'à vouloir: tout peut se changer en tout; tout peut l'extraire de tout;" and though we have now learnt much of the laws by which these magical transformations proceed, they far transcend the dreams of the French philospher; there is yet no visible limit to the multitude of products to be derived from the vegetable and animal world, and their changes seem to afford boundless scope for chemical ingenuity. The benefit here also is reciprocal; for the physiologist enters by our aid into the wonderful laboratory of the living plant or animal, and learns to estimate the mode of action of different foods and medicines. There have lately been some good researches of this character; the difficulties are great, but the results to be achieved are worthy of any effort.

There may be little intercourse between us and the geographers in E, but we stand in no distant relationship with many of the subjects discussed in F. Economic science embraces the chemical arts from cookery upwards; such imperial questions as that of the national standards, or the patent laws, interest us greatly; the yield of our corn-fields is increased through our knowledge of the constituents of soils and manures, and upon many of the chemical manufactures depend in no small degree the commerce and the wealth of Britain.

In this most important branch of technical chemistry we need the skill of the mechanician; and this introduces us to Section G. One of the questions of the day will illustrate the connexion between these varied departments of study. Statistics prove that the consumption of coal is now advancing, not at the gradual pace which recent calculations allowed, but at a rapidly accelerating speed, and they make the householder anxious about rising prices, and the political economist about the duration of our coal-fields. It is well known that there is a great waste of fuel throughout the country, as the maximum of heat produced by the combustion is very far from being ever utilised; and it will be for the combined wisdom of the chemist, physicist, and mechanician to devise means for reducing this lavish expenditure, or to indicate other available sources of power.

While this correlation of the natural sciences renders it desirable that the votary of one should have some general acquaintance with the rest, the correlation of all knowledge shows that no education can be complete which ignores the study of nature. A mind fed only on one particular kind of lore, however excellent that kind may be, must fail of proper nourishment. I am not going to say a word against philological studies: I am too fond of them myself for that; and I could wish that the modern languages were taught more, and the classic languages were taught better than they are at present. What I do contend for is, that chemistry (or some cognate branch of science) should have an honoured place in the education of every English lady and gentleman. I say purposely "an honoured place;" for at present where chemistry is introduced we too often find the idea latent which was expressed by one principal of a lady's college, who told a friend of mine that he was to give the girls a course of pretty experiments, but that she did not expect him to teach them anything; and we know that when boys repeat chemical experiments at home it is looked upon as an amusement, a philosophical one no doubt, but rather objectionable, inasmuch as they spoil their mother's towels, and singe their own eyebrows.

Of course some knowledge of chemistry is indispensable for a large number of our manufacturers, and for the medical profession, while it is extremely valuable to the farmer, the miner, and the engineer. It will also be readily granted that information about the air we breathe, the water we drink, the food we live upon, the fuel we burn, and the various common objects we handle, must be of service to every man. But we are met by the advocates of the old system of education with the remark that the value of school-teaching does not depend so much upon the information given as upon the mental training. This I admit: though it seems to me that if the same training can be secured by two studies, the one of which (like the making of Latin verses) gives no information at all, and the other (like chemical analysis) imparts some useful knowledge, we should prefer the latter. But I hold that as a means of educating the mental faculties, chemistry, faithfully taught, has in many respects the advantage over literary studies. There is superabundant scope for the exercise of the memory; the powers of observation are developed by it to a wonderful degree; the reasoning powers may be well disciplined on the philosophy of chemical change, or the application of the laws of Dalton, Mitscherlich, and Avogadro; while the imagination may be cultivated by the attempt to form a conception of the ultimate particles of matter, with their affinities and atomicities, as they act and react upon one another under the control of the physical forces. And I might speak of higher considerations than mere intellectual culture; for surely the works of the Allwise and Bountiful Creator are a more truthful and a purer subject of contemplation for the opening minds of youth, and more in accordance with Christian ideas, than are the crude notions of a past stage of civilisation, and the ignorant and gross fancies of a defunct paganism.

There is another requirement in education—the training of the mind to the discovery and recognition of truth. For this purpose philological studies have no fitness; mathematical studies, though peculiarly adapted for it, apply only to cases where demonstrative proof is possible; but the study of physical science is remarkably well fitted for teaching the proper methods of inquiry, and the strict relations between theory and fact. Now the historian, the politician, the mental philosopher, the theologian, or any one else who desires to influence the thoughts of his fellow men, should be in a position to distinguish between truth and error in his own department; and his mind may be well disciplined for this by a study which is less liable to be disturbed by human passions, predilections, or wishes, and where the conclusions are more readily brought to the test of observation or experiment.

Our Government insists on a certain standard of education for all who are allowed to teach in our elementary schools. In those schools which receive no state aid it is only public opinion which can insist that the teacher shall be duly qualified himself. Such bodies as the British Association form this public opinion, and will deserve well of their country if they demand that these masters and mistresses shall know something of the material universe in which they move, and be able to

impart to every child such scientific knowledge as shall afford him an interesting subject for thought, give him useful information, and discipline his mental powers.

Among the many services rendered by the monthly reports of the progress of chemistry which the Chemical Society publishes, and the British Association helps to pay for, there is one which is rather salutary than pleasant. They bring prominently before our notice the fact that in the race of original research we are being distanced by foreign chemists. I refer, not to the quality of our work, about which opinions will probably differ, but to the quantity, which can be determined by very simple arithmetic. This is a matter of no small importance, not only for the honour of England, but still more for the advancement of science and the welfare of man. From the Physical Chair of this Association last year, a note of warning was uttered in the following words, after a reference to the sad fate of Newton's successors who allowed mathematical science almost to die out of the country:—"If the successors of Davy and Faraday pause to ponder even on *their* achievements, we shall soon be again in the same state of ignominious inferiority." The President of the Chemical Society also, in the last Anniversary Address, drew attention to the diminished activity of chemical discovery, and to the lamentable fewness of original papers communicated. He traces this chiefly to "the non-recognition of experimental research by our universities," and suggests that in granting of science-degrees every candidate should be required, as in Germany, to prove his ability for original investigation.

Concurring in this, I would remark that other causes have also been assigned, and other suggestions have been made. There is the small recognition of original research even by our learned societies—at least such recognition as will come home to the understanding of the general public. It is true the fellowship of the Royal Society is awarded mainly for original discoveries, and there are two or three medals to be disposed of annually; but these distinctions fall to the lot of the seniors in science, often men who are beyond the need of encouragement; and though they doubtless are serviceable as incentives, there is many a beginner in the honourable contest of discovery who is too modest even to hope for the blue ribbon of science. While the Victoria Cross is awarded to few, every soldier who has borne part in a victory expects his clasp; and so might every man who has won victories over the secrets of nature fairly look for some public recognition. It has been suggested, for instance, that the Royal Society, in addition to the F.R.S., might institute an Associateship, with the letters A.R.S., designed exclusively for those younger men who have shown zeal and ability in original research, but whose discoveries have not been sufficient to entitle them already to the Fellowship. It is suggested, too, that the Chemical Society might give some medal, or diploma, or some similar distinction, to those who contribute papers of sufficient merit.

But beyond this is the non-recognition of scientific research by society in general. We can scarcely expect the average enlightened Englishman to be anything but scared by a graphic formula, or a doubly sesquipedalian word containing two or three compound radicals; but he need not continue to talk of the four elements, or of acids being neutralised by sugar. But, indeed, the so-called educated classes in England are not only supremely ignorant of science, they have scarcely yet arrived at the first stage of improvement—the knowledge of their own ignorance. Then, again, there is the excessive preference of practical inventions over theoretical discoveries; or rather, perhaps, the inability to appreciate anything but tangible results. Thus a new aniline compound is nothing unless it will dye a pretty colour; if we speak of the discovery of a new metal by the spectroscope, they simply ask—What is it useful for? and the rigorous determination of an atomic weight has for them no meaning nor interest nor beauty. The general appreciation of science must be of gradual growth; yet there are wealthy men who know its value, and who might well become the endowers of research. There are, indeed, at present funds available for the purpose—such as the Government Grant, and the surplus funds of this Association; but the money is given simply to cover actual outlay, and this, though very useful, scarcely meets the case of those young philosophers who have no balance at their bankers, and yet must live. Will not some of these wealthy men endow experimental scholarships, or professorships, in connection with our colleges, institutions, or learned societies? As an instance of the good that may be effected in this way, may be cited the Fullerian professorships; and as a very recent example, worthy of all honour, may be mentioned the purpose of Mr. J. B. Lawes, not only to continue his elaborate experiments at Rothamsted throughout his lifetime, but to place his laboratory and experimental fields in trust, together with £100,000, so that investigations may be continued in the wider and more scientific questions which the progress of agriculture may suggest.

The Government of our country, through the Science and Art Department, renders good assistance to the teaching of science, and if the recommendations of the Royal Commission on Scientific Instruction and the Advancement of Science be adopted, the introduction of practical examinations for the obtaining of certificates for a superior grade of science-master will certainly foster a spirit of research. It has been generally held that the promotion of research is within the legitimate scope of Government; and where, as in the case of Aristotle and Alexander, genius and industry have been sustained by princely munificence, the happiest results have ensued. Yet this question of Government aid is a delicate one: for genius, when put into swaddling clothes, is apt to be stifled by them; and were science to depend on political favour or imperial support, it would be a fatal calamity. Still I think it will be everywhere admitted that science might with propriety be subsidised from the public funds in cases where the results may be expected to confer a direct benefit upon the community, and where the inquiry, either from its expense, its tediousness, its uninteresting character, or the amount of co-operation required, is not likely to be carried out by voluntary effort. The astronomical work which is paid for by Government bears upon navigation, and answers both these requirements; and it is easy to conceive of inquiries in our own science that might equally deserve the assistance of the State. Some of these might also more than repay the outlay, though perhaps the profit would not fall into next year's budget.

I believe that this diminution of original research, which we deplore, is partly due to a cause in which we rejoice—the recent extension of science-teaching. The professorships of chemistry are scarcely more numerous now than they were twenty years ago, while the calls upon the professor's time in conducting classes, or looking over examination papers, have greatly augmented. Thus some of the most capable men have been drawn away from the investigation of nature; and in order to afford them sufficient leisure for the purpose, means must be found to multiply the number of the professorships in our various colleges.

While the rudiments of science are being infused into our primary education, now happily becoming national, while physical science is gradually gaining a footing in our secondary and our large public schools, and while it is winning for itself an honourable place at our universities, it is to be hoped that many new investigations will arise, and that British chemists will not fall behind in the upward march of discovery, but will continue hand in hand with their continental brethren thus to serve their own and future generations.

THE ANALYSIS OF WATERS IN INDIA.*

By EDWARD NICHOLSON, F.C.S.,
Assistant Surgeon R.A., Analyst of Waters, Mysore, Northern and Ceded Districts.

(Concluded from p. 65).

Passing now to the more important quantitative analysis, we find the processes indicated hardly more trustworthy than those already noticed. The first determination does not look promising:—

"*Total solids.*—Evaporate to dryness half a litre of the water (or a litre or more) . . . . The evaporation is preferably carried on from first to last in a platinum capsule, but the evaporation may be carried to a small bulk in a porcelain capsule, and the residue transferred by the aid of a wash bottle and a very flexible steel spatula, to the weighed platinum capsule in which the operation is to be completed."

I need hardly say that however flexible be the spatula, the operation thus sanctioned would be fatal to any pretensions of accuracy, and it seems rather superfluous to add, "Whichever plan is adopted, the capsule should be protected during the operation with a piece of filtering paper to keep out dust."

The next process is scarcely more commendable:—

"*Silica.*—Treat the ignited residue with dilute hydrochloric acid, taking care to avoid loss by effervescence, dilute with water, and if the silica is in any quantity, or if an exact analysis is required, collect it in a filter, wash, dry, ignite, and weigh."

In these directions the necessary ignition of the liberated and soluble silicic acid is omitted, so that whether the analyst collects such silicic acid as may perchance be visible, or whether he avails himself of the permission to neglect it, the chances of accuracy are not much affected. It will be remarked that the show of accuracy in the caution against loss by effervescence, or gain by fortuitous dust, is accompanied by neglect to mention the most necessary precautions, and by permission to pass over a substance like silicic acid, often amounting to a fourth or a third of the whole solid constituents of a water.†

These are, however, trifling sins compared to the following gross inaccuracy in the process given for the determination of alkaline chlorides:—

"Add some chloride of ammonium (to convert sulphate of sodium or potassium into the chloride), evaporate, ignite, and weigh the residual chloride of sodium and potassium. If the water contain only a small proportion of sulphuric acid, the addition of the chloride of ammonium will suffice for the conversion of the sulphates into chlorides; but if the proportion of sulphuric acid is large, it is necessary to add at once before the addition of the milk of lime a quantity of chloride of barium equivalent to the known amount of the sulphuric acid."

The author of the scheme here distinctly commits himself to the statement that ignition of sodium sulphate with ammonium chloride changes the former into sodium chloride. Little or much sulphuric acid can make no difference in the reaction. *This statement is without the slightest foundation in fact.* Sodium sulphate ignited even with a considerable excess of ammonium chloride shows no signs of change, the weight remains unaltered, and the solution of the residue gives no indication of chloride being present. The experiment is easy to perform, so that anyone can test for himself the accuracy of the statement I here challenge. The reactions of ammonium salts (sulphate, chloride, carbonate) on the mineral constituents of water are cardinal points in water analysis, and I have no hesitation in expressing my opinion that the above statement is in itself sufficient for the rejection of the scheme compiled by the Chemical Examiner to the Government of India.

* Communicated by the Author.

† An Indian water containing 30 to 40 c.grms. per litre of solids will often contain 10 to 12 c.grms. of silica.

In conclusion I beg to disclaim any cavillous spirit in thus drawing attention to the fallacies of the three schemes of water analysis which have succeeded one another during the last two years. Had I remained silent I should have failed in the duty I owe to my profession as a chemist. I have endeavoured, in as moderate a manner as possible, to expose errors which are unfortunately too often overlooked in the desire of the medical profession for a royal road to a science which nothing but long practical experience can teach. In the course of these papers I have fixed as much as possible on certain points where any objector could join issue with me, but I have met with no reply, save in a single instance—that of my experience with the albumenoid ammonia process for the estimation of organic matter.*

With this exception my criticisms of the authorised methods of analysis have met with no defence, and I think that it is now time for action to be taken on this question.

The necessity of a sound system for the chemical examination of waters is obvious; as long as the results obtained are erroneous,—as long as not only the quantity but the very presence of the substances found is uncertain in the highest degree—so long will sanitary science endeavour in vain to formulate the qualities distinctive of good and bad water. The laws by which the Bengal Chemical Examiner judges waters are given in the Sixth Report on the Analysis of Waters, they are entirely compiled from English theories, and would have condemned every water in Bengal, had not the wretched mode of examination prescribed defeated their rigorous provisions. They may be thus summarised.

(There are nine or ten defects possible in a water, anyone of which is strong evidence of sewage contamination, but the absence of any or all of them is no proof that the water has not at some previous time been polluted.)

When we find that these lynch laws and these peculiar rules of evidence are joined to a system of examination so defective that waters are condemned as foul for the most doubtful reasons, while it totally fails to elicit the facts on which judgment should be based, it is evidently high time for reform in that department of science which has so long passed for chemistry in India.

A few examples of the chemical evidence current in Bengal may here be quoted. The waters of the station of Hurripore are thus disposed of in the first report under my hand:—

"Lime is here very abundant in the waters, and goitre is said to be common. The water of the new well in the Fort is very inferior, quite unfit for drinking purposes, being loaded with the remains of excrementitious matter."

I turn to the columns of analyses and find that the only notable difference between the two well waters considered "fairly good," and that loaded with the remains of excrementitious matters (No. 3) is in the following particulars.

	1.	2.	3.
Oxygen required for 1000 grs. of water..	0·00198	0·00193	0·0044
Nitrous acid	Trace.	None.	Present.
Minerals solids grs. per gallon	17·95	20·80	24·50
Chloride of sodium ,, ,,	0·675	1·65	7·05

It is stated that neither of the three contained ammonia or nitric acid. (I pass over items of doubtful accuracy or importance.) The excess of oxygen required for No. 3 is no more than would be caused by 0·1 gr. of nitrous acid,

* On this point I was mistaken. My experiments failed with the apparatus supplied to me for working this new process, but I have since succeeded by the use of apparatus of my own construction. I was also misled to a great extent by the incomprehensible results of some of the examinations made by this method in India, and published. It will, however, be remembered that I gave the results of my experiments with some distrust, and with the announced intention of drawing forth the experience of other analysts on the value of this novel process. I do not regret this in any way, as I succeeded in bringing forward Mr. Harvey's experience; in consequence of which I tried again with proper apparatus, and with good results. Of the practical value of the process I am not yet satisfied; I am still examining that part of the question.

and as the latter is present the evidence of the former drops. We thus find that the remains of excrementitious matters with which the water is said to be loaded, reduce themselves to 0·1 grain of nitrous acid, and a moderate amount of chloride of sodium; both of very natural occurrence in a new well, and affording *per se* not the slightest evidence of sewage contamination, past or present.

Another instance. We are told of Mean Meer that "the whole of the soil is thoroughly saturated with sewage matters; under these circumstances there is little hope of ever procuring drinkable water from any of the wells . . . there is abundant evidence to show that this typhoid fever is almost entirely due to the presence of sewage matters in water and air; . . . it is also believed that diarrhœa and cholera constantly result from the use of impure water;" and it is recommended that all the wells should be filled up. It certainly appears that the water is of unpleasant quality (though on the whole rather superior to that of the seven wells as supplied to the troops at Madras), but from the chemical evidence nothing can be brought in support of the charges of sewage contamination either of soil or of water. The following table gives a summary of the chemical examination of the twenty-six well waters.

	Extreme Quantities.	Average.
Oxygen required per million parts	0·25 to 1·6	—
Nitrous acid	None in 19, traces in 7	—
Nitric acid	Traces in 13, none or—in 13	—
Sulphuretted hydrogen	Traces in 24	—
Mineral solids, grains per gallon	33·4 to 86·2	50
Volatile solids, grains per gallon	0·45 to 2·94	1
Earthy salts	4·1 to 16·1	7
Chloride of sodium	1·4 to 5·5 (1 of 11·5)	3
Sulphate of soda	3·8 to 16·4	8
Carbonate of soda	12·7 to 59·2	40

These waters appear to be soft and very alkaline (a kind of Vichy water?); the sulphuretted hydrogen is almost certainly caused by decomposition of the alkaline sulphates; it will be remarked, however, that in several waters it is noted as existing along with nitrous acid, a very improbable occurrence, but either of these two substances would deoxidise the permanganate test, lessening considerably any importance that may be attached to the very moderate amount of oxygen said to be consumed by the water. The general absence of nitric acid, and the small amount of chloride of sodium, is strong evidence against sewage contamination. The principal ingredient appears to be carbonate of soda, perhaps the least objectionable saline substance it is possible to have in a water, and certainly not derived from sewage. I look in vain for any evidence in support of the charges; I can only find evidence tending directly to acquit both the soil and the water of the charges laid against them. There is not the slighest doubt that the well waters of ground generally contaminated by sewage show the traces of it most unmistakably, and therefore one, at least, of two things is certain, either that the charges made against the soil and waters of Mean Meer are devoid of foundation, or that the analyses, so called, are worthless. Here is a specimen of what has been done for sanitary science by four years of water analysis under the old system. Is there any guarantee that the new system of analysis will produce better results? No; the causes being the same, the effects will not change.

CORRESPONDENCE.

ESTIMATION OF MANGANESE.

To the Editor of the Chemical News.

Sir,—I have read the article on the "Estimation of Manganese," Chemical News, vol. xxvi., p. 37, contributed by Mr. Hugo Tamm. That gentlemen seems to have hit on a method of precipitating manganese which is possessed of some advantages, though I hardly think he is the originator of it; for, if I am not mistaken, Mr. Mattieu Williams employed the same reagent in the same manner when chemist at the Atlas Works some years ago. Be this as it may, the precipitation of manganese by ammonium carbonate is certainly complete, provided no free ammonia be present. I cannot say that I have found the precipitate to settle readily, some hours being required for tolerably complete subsidence. Mr. Tamm seems to be very imperfectly acquainted with the practice or literature of manganese estimations, for he apparently imagines the usual process employed to be the precipitation as sulphide, with re-solution and precipitation as carbonate. Upon such a method there can be no doubt the plan proposed is a great improvement, involving as it does but one precipitation instead of two. But has Mr. Tamm never heard of the bromine process, which not only precipitates the manganese in a form fit for weighing, but leaves—what is apparently Mr. Tamm's *bête noire*—the calcium in the filtrate?

It is commonly assumed that the bromine method is not applicable in presence of ammoniacal salts, but this is a mistake, for they seem to present little or no obstruction to its use. *Free* ammonia is, of course, decomposed by bromine, but the reaction occurs only very slowly in cold and dilute liquids, so that a solution of manganese, made slightly alkaline with ammonia in presence of ammonium salts, is readily and completely precipitated by bromine. As no fixed alkalies are employed, re-solution of the precipitate is quite superfluous.

Interesting as Mr. Hugo Tamm's contributions usually are, I trust he will excuse me if I suggest that they give the reader the impression that his knowledge of standard methods of analysis is derived from a single text-book, and that not a very recent one. Otherwise, it is difficult to understand how he could have been led to describe a process of estimating copper which is found in most works on analysis, the only novelty in his method being the use of ammonium in place of hydrogen sulphite, and ammonium sulphocyanide instead of potassium sulphocyanide. Mr. Tamm has also described a method of precipitating manganese as ammonio-phosphate, a process which originated with Dr. Wolcott Gibbs. But in these days, when analytical processes are published in many journals and several languages, it is next to impossible for those chemists who have not the advantage of a scientific library to keep up with the advance of analytical chemistry, especially in those branches of the subject in which they have no direct and daily interest. But does Mr. Tamm seriously imagine that any analyst worthy of the name is in the habit of separating iron from manganese by means of ammonia, except as a *rough* method of *qualitative* analysis? Mr. Tamm very rightly prefers to separate the iron with succinate of ammonium; but has he really tried this precipitant on the solution of 100 *grs.* of spiegeleisen, the quantity he recommends for the purpose? If not, let him accept my recommendation to try it, and, *when* he has filtered and thoroughly washed the iron precipitate, to communicate the result, and any remarks he may desire to make thereon. Every analyst has his pet methods, and those processes are the best to which he is most accustomed; but let me recommend Mr. Tamm to use ammonium acetate for the separation of iron and manganese, precipitating the latter metal from the filtrate by means of bromine, after concentration and addition of enough ammonia to render the liquid slightly alkaline. He can then precipitate any calcium or magnesium from the filtrate in the usual way.

No doubt the precipitation of manganese by ammonium carbonate may prove very useful occasionally, and Mr. Tamm has made a suggestion of considerable value in proposing it as a means of separating manganese from nickel and zinc.

In Sheffield the separation of iron and manganese is

an everyday affair, and I have made many attempts to effect the estimation of manganese in spiegeleisen without first separating the iron. In this I have hitherto been unsuccessful, but am not without hope of ultimate success.—I am, &c.,

Alfred H. Allen.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, August 5, 1872.

This number contains, in addition to several important papers on meteorology, astronomy, anatomy, and natural history, the following original memoirs relating to chemistry:—

Researches on Alcoholic Fermentation.—Prof. J. Dumas.—This exhaustive essay treats at great length on the much-discussed question of the real nature of fermentation. The eminent *savant* draws the following conclusions from his investigations:—No chemical movement excited in a saccharine liquor can convert sugar into alcohol and carbonic acid; the simple fermentation of a saccharine liquor and yeast may be regulated like any other chemical reaction; the duration of the fermentation is exactly proportionate to the quantity of sugar contained in the liquid; fermentation proceeds more slowly in the dark and *in vacuo*; no oxidation takes place during the fermentation; sulphur is converted into sulphuretted hydrogen by the fermentation; neutral gases do not modify the fermentation-inducing action of yeast; acids, bases, and salts can exercise an accelerating or retarding, disturbing or destructive, action on fermentation, but the accelerating action is more rarely observed; very dilute acids do not affect fermentation, but acids in larger quantity completely destroy it; the same applies to alkalies; carbonated alkalies only impede fermentation when they are present in, or added to, the fermenting liquid in large quantity; earthy carbonates do not interfere with fermentation; neutral salts of potassa and of some other bases exert no influence upon the process; silicate of potassa, borate of soda, soap, sulphites, hyposulphites, neutral tartrate of potassa, and acetate of potassa may be applied for the physiological analysis of ferment and for studying its mode of action.

Ferments Belonging to the Diastase Group.—Prof. J. Dumas.—This paper treats more particularly on the curious action of borax upon yeast, albumenoid substances, synaptase, diastase, myrosine, and malt extract, the salt completely neutralising the known effects of these substances.

Analysis of the Light Emitted by the Phosphorescent Compounds of Uranium.—E. Becquerel.—This exhaustive spectroscopical memoir is illustrated by woodcuts.

Improvement of Wines by Heating them.—Dr. Pasteur.—The contents of this memoir, to which is added a lengthy *procès-verbal* on the results of the investigation of a committee (consisting of wine-growers, wine-merchants, scientific men, and officials of the Ministry of Agriculture) on the subject of wines heated and not heated, chiefly interests wine-growing countries; we may, however, mention that the application of heat tends to improve wines.

Rapid Estimation of Phosphoric Acid, Magnesia, and Lime.—Dr. G. Ville.—Reserved for full translation.

Decolourising Effect of Concentrated Ozone.—A. Houzeau.—It appears that ozone greatly surpasses chlorine in its decolourising effects; this is shown by the action of these substances upon sulphate of indigo and other pigments; the destruction of the indigo is accompanied by the formation of oxygenated water (peroxide of hydrogen).

Some of the Derivatives of Tetrachloride of Naphthaline.—E. Grimaux.—The author describes the following compounds, the modes of preparation of which are recorded at length:—Bichlorated naphthyldrenic glycol—

$$C_{10}H_8Cl_2\left\{\begin{matrix}OH\\OH\end{matrix}\right.$$

a solid crystalline body, slightly soluble in cold water, soluble in about thirty times its weight of boiling water, and readily soluble in alcohol and ether; it fuses at 156°, and yields, with chloride of acetyl, a diacetate—

$$C_{10}H_8Cl_2\left\{\begin{matrix}OC_2H_3O\\OC_2H_3O\end{matrix}\right.$$

a solid crystalline body. With chloride of benzoyl, a dibenzoate is formed—

$$C_{10}H_8Cl_2\left\{\begin{matrix}OC_7H_5O\\OC_7H_5O\end{matrix}\right.$$

a substance soluble in alcohol and ether, and fusing at from 148° to 150°. When bichlorated naphthyldrenic glycol is distilled with hydrochloric acid, there is formed monochlorated naphthol, $C_{10}H_6Cl,OH$, also a solid crystalline body, slightly soluble in cold, more so in boiling, water, and fusing at 109°; when this substance is dissolved in sulphuric acid, the addition of a crystal of oxalic acid produces a violet colour.

Annalen der Physik und Chemie, von Dr. J. C. Poggendorff, No. 6, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

Manometrical Flames.—Dr. R. König.—This essay, illustrated by woodcuts, treats on acoustics.

Caloric Spectrum of the Sun and of Lime-Light.—S. Lamansky.—A lengthy spectroscopical memoir, illustrated by several engravings.

Experimental Researches on Fluorescens.—E. Hagenbach.—The continution of an exhaustive monograph on this subject.

Conducting Power of Iron and Argentan for Heat.—H. Weber.—An algebraico-physical essay.

Newly-Contrived Modification in the Construction of Holtz's Influence Machine (Influenz-Maschine) Constructed with Discs Rotating in Opposite Directions.—W. Musæus.—Illustrated by engravings.

Identity of the so-called Immature Amber with Krantzite.—Dr. H. Spirgatis.—The krantzite investigated by the author was of the same consistency as the specimen of immature amber lately found in small quantity in the Baltic near the coast, and the krantzite behaves with solvents in the same manner. The specific gravity of the last-named mineral varies from 0·9822 to 0·9845, and its fusion-point was found by the author to be the same as that of the unripe amber, viz., 300°. The chemical composition of both the substances agrees very closely, and succinic acid is found in neither. According to Dana, krantzite is essentially succinite; it occurs in small grains and masses of a light yellow or greenish yellow colour; externally it has a reddish or brownish hue. The formula of krantzite is $C_{40}H_{64}O_4$.

Annales des Mines, No. 2, 1872.

This number contains no original papers relating to chemistry.

Bayerisches Industrie und Gewerbe-Blatt, July, 1872.

Detection of Fatty Oils in Ethereal Oils.—F. Rhien.—The process, described and illustrated by woodcuts, essentially consists of a careful process of distillation conducted with a small, but previously weighed or measured, quantity of the essential oil under investigation.

Preparation of Ferricyanide of Potassium.—F. Rhien.—To the cold saturated solution of ferrocyanide of potassium is added a sufficient quantity of rough hydrochloric acid to withdraw 1 atom of potassium from 2 atoms of the salt. There is next gradually added to this mixture a clear solution of hypochlorite of lime (bleaching-powder), until a small quantity of the fluid, tested with perchloride of iron does not indicate the presence of ferrocyanide of potassium; the fluid is then neutralised with chalk, and, lastly, evaporated to crystallisation. The advantages of this process are stated to be—(1) Conversion of the ferro- into ferri-cyanide at the ordinary temperature; (2) only one filtration, and no necessity of washing out a precipitate; (3) nearly the whole of the ferricyanide is obtained by crystallisation, while the last traces may be utilised by means of precipitation with sulphate of iron.

Preparation of Good Lutes and Cements.—Dr. Feichtinger.—This exhaustive memoir treats on—Oil cements; resin cements; glue and gum cements; casein cements; water-glass cements; lime gypsum, pipe-clay, and iron cements.

Annales de Chimie et de Physique, August, 1872.

This number contains the following original papers and essays:—

Researches on the State of Salts when in Solution.—Drs. Berthelot and L. de Saint-Martin.—This monograph is divided into the following sections:—Method and mode of operation; condition of acid salts when in solution; acid salts formed by acetic, benzoic, and polybasic acids; bisuccinates of potassa and ammonia. The general results of these researches may be summarised as follows:—The acid salts formed by monobasic acids do not exist in dilute solution; those formed by polybasic acids become partially decomposed; the quantity decomposed increases gradually, according to the increased dilution of the solution; this quantity continually varies, according to the *rapport* existing between the neutral salt and the excess of acid, and this variation takes place so that the stability of the acid salt is increased either by the presence of another neutral salt or by the presence of an excess of free acid; division of one base between two acids.

Thermic Researches on Sulphur.—Dr. Berthelot.—The contents of this essay may be summarised as follows:—The conversion of dissolved octahedrical sulphur into insoluble sulphur, under the influence of direct sunlight at the ordinary temperature of the air, is accompanied by an evolution of heat equal to about +12·8 cal. to the grm. The conversion of ordinary molten sulphur into insoluble sulphur, at 113°, is also accompanied by an evolution of caloric; this change does not take place by the simple fusion of pure octahedrical sulphur, but it occurs under the influence of sunlight.

Oxysulphide of Carbon.—Dr. Berthelot.—Oxysulphide of carbon is a gas prepared by the action of dilute sulphuric acid upon sulphocyanide of potassium; the formula of this gas is $C_2O_2S_2$. It yields with ammonia a compound, $C_2H_4NS_2O_2,NH_3$, carbamate of oxysulphide of ammonia, and, by the withdrawal therefrom of 2 equivalents of water, this substance yields sulphocyanide of ammonium, and, by the withdrawal of 2 equivalents of sulphuretted hydrogen, it yields urea, $C_2H_8NS_2,NH_3 - H_2S_2 = C_2H_4NO_2$.

Experimental Researches on the Duration of the Electric Spark.—F. Lucas and A. Cazin.—This essay, elucidated by engravings, is divided into the following sections:—Principle of the chronoscope lighted by electric sparks; description of apparatus; preliminary experiments; influence of the surface of the condenser; influence of the resistance of the conducting circuit; general formula for expressing the duration of the spark, as indicated by the functions of the three variable exponents, x, y, z.

Freezing of Water.—Prof. Boussingault.—After referring to the old experiments of the Fellows of the Academia dell Cimento at Florence, and also to the researches of Huyghens (1667), the author records the results of a series of experiments which fully prove that, if the resistance of the sides of the vessel (wherein water is exposed to great cold, the vessel being hermetically sealed) is greater than the expansive force of the act of congelation of the water, the latter remains liquid even at the lowest temperatures to which it is exposed.

Journal für Gasbeleuchtung und Wasserversorgung, No. 8, 1872.

This number contains the following original paper relating to chemistry:—

Influence of Coal-Gas upon Vegetation.—Dr. Virchow.—The author gives a detailed account of a series of experiments made, at the request of the municipal Government of Berlin, by himself and a committee of scientific men, for the purpose of elucidating the question whether the infiltration of coal-gas, in the soil whereupon plants and trees are grown, is or is not injurious to these. The result of the carefully-conducted researches is that coal-gas is an active poison to vegetation, and that trees, shrubs, and ornamental plants are killed by it.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, June 2, 1872.

Deviation of Smoke of Sea-Going Steamers.—Ch. Mène.—The author states that some officers of the Austrian navy have made experiments for causing the smoke arising from the fuel consumed in steam-ships to be discharged under water by the aid of a blowing machine; at the same time a more active and regular combustion is obtained, and the chances of fire on board greatly lessened, while the funnel or iron chimney, one of the most vulnerable parts above deck, is rendered unnecessary. The author has reason to believe that the experiments were in every respect successful.

Improved Safety-Tubes to be Applied instead of Woolf's Tubes.—Ch. Mène.—In a short paper, illustrated with woodcuts, a description is given of a neat contrivance, invented by Alvergnat, Frères, at Paris. The tubes are less liable to breakage and taking up less space than Woolf's.

Action of Sulphuric Acid on Wine.—Dr. L. de Martin.—The author has studied the effect of small quantities (from 1 to 3 grms. of concentrated acid to the hectolitre=22 gallons) of sulphuric acid upon the process of the fermentation of the must, the result being (1) more rapid and more complete fermentation; (2) a better and more beautiful colour of the wine; (3) analysis did not detect more sulphuric acid in this wine than in samples not so treated, while all the samples had been, as it is termed in Southern France, *plâtrés*, that is to say, treated (cleared) with gypsum. Dr. G. Chancel has repeated these experiments and more thoroughly investigated the process of the fermentation of must, and has found that when the must is alkaline, as it sometimes is, either from some unexplained cause inherent to the juice, or, or as is more usually the case, in consequence of much rain, the grapes are spattered and more or less covered with soil. The process of fermentation produces lactic acid instead of alcohol; hence the utility of the sulphuric acid for the purpose of setting up the alcoholic fermentation of the sugar. Dr. Chancel found no increase in the quantity of the sulphuric acid contained in wine so treated. Alcoholic fermentation is not possible in an alkaline fluid, the result in such a case being the formation of lactic acid, formed from the sugar.

American Journal of Pharmacy, August, 1872.

Monobromated Camphor.—Dr. J. M. Maisch.—After referring at some length to the researches of Th. Swart's, Laurent, Perkin, and others, the author describes at great length the results of his experiments made for the purpose of preparing monobromated camphor, which is now largely used medicinally in the United States. The process of preparation is divided into three distinct operations—(1) the combination of bromine with camphor, bibromide of camphor, which takes place at the ordinary or slightly elevated temperature, particularly in the presence of a trace of alcohol; (2) the formation of the substitution compound, monobromated camphor, which may be effected at a temperature of 100°, or in a much shorter time at 132°; (3) the utilisation of the oily residue, a by-product of the first action of bromine upon camphor, the greater part of which is converted into the substitution compound at 260°. Equivalent weights of camphor and bromine are used (the combining weight of camphor, $C_{20}H_{16}O_2$, is 152; that of 2Br=160), but in practice one-twelfth more of camphor is advisable. Monobromated camphor crystallises from alcohol in thin white or colourless prisms or needles; from petroleum-benzine it may be obtained in long flat prisms, which are perfectly transparent and hard. It is insoluble in water, readily soluble in alcohol, ether, and in less than its own weight of hot petroleum-benzine; it is permanent in the air, and not affected by direct sunlight; it fuses at about 67°, and boils, with partial decomposition, at 274°.

Some of the Constituents of the Rhizome of Sanguinaria Canadensis.—E. Peirpoint.—It appears that this drug contains puccin, sanguinarin, and sanguinaric acid; but the quantities of these substances obtained by the author at present are not large enough to admit of a full investigation of their properties and elementary composition, which will form the subject-matter of a future paper.

Disinfection of Sponges.—M. Leriche.—The sponges are first impregnated with a solution of 4 parts of permanganate of potassa in 100 parts of water, and next placed in a solution of 25 parts of sulphurous acid to 100 of water, and finally well washed with water. By this treatment sponges acquire their original condition, and even their marine odour, although they may have been soaked in pus and infectious matter.

Les Mondes, August 8, 1872.

In addition to several original papers and memoirs strictly relating to pharmacy, astronomy, meteorology, agriculture, and medicine, this number contains:—

Petites Annales de Chimie.—Dr. J. Maumené.—The continuation of a monograph on theoretical chemistry, elucidated by a series of algebraic and chemical formulæ.

On some Phenomena observed at Alatri (Italy), and the Effects of Lightning.—Rev. Father A. Secchi, S.J.—The eminent *savant* first gives an account of the difficulties encountered some eight years ago, when a lightning-rod was established on the cathedral and campanila of Alatri, buildings which, by their very isolated and elevated position, had often been injured by lightning. The greater portion of this essay is devoted to a minute description of the curious effects of a severe thunderstorm which took place on November 2nd, 1871, and which, while not materially injuring the building alluded to, shows that great care should be taken in the construction of lightning-rods of the proximity of iron gas- and water-mains (underground) comparatively near the spot where the claws of the lightning conductor are placed in the soil.

Bulletin de la Société Chimique de Paris, June 15, 1872.

This number contains the following original papers and memoirs:—

Researches on the Reciprocal Action between some Metals and Iodide of Acetyl.—H. Gal.—The author briefly refers to the researches of Wislicenus and Ponomaroff on this subject, and then states that while granulated zinc and small lumps of sodium are very strongly acted upon by iodide of acetyl, this does not take place when tin and mercury are brought into contact with that body; the result of the reaction being the formation of acetic acid, and a small quantity of a liquid heavier than water, and capable of combining with bromine.

Chlorobromide and Chloroiodide of Propylen.—C. Friedel and R. D. Silva.—This essay treats on the best modes of preparation of these bodies, and the reactions they exhibit. The contents of this paper are not, however, well suited for abstraction.

Action of Chloride of Iodine upon Chloroform, upon the Iodides of the Alcohol Radicals, and upon the Action of Bromine upon Chloroform.—C. Friedel and R. D. Silva.—The ultimate result of the action of chloride of iodine upon chloroform, which operation takes place in a sealed tube at from 160° to 170°, is the formation of tetrachloride of carbon, according to the formula $CCl_3H + 2ClI = CCl_4 + HCl + I_2$. It appears, however, that a small quantity of chloroiodide of carbon is also formed. Chloride of iodine acts strongly upon the alcohol radicals, converting these readily into chlorides, iodine being eliminated. By the action of bromine upon chloroform there is formed chlorobromide of carbon, CCl_3Br, a limpid fluid, sp. gr. at 0°=2·063.

Synthesis of Orcin, and on some Sulphurous Derivatives from Toluen.—G. Vogt and A. Henniger.—The contents of this essay have been already referred to, but the results of the authors' investigations are published *in extenso*.

Preparation of the Salts of Cæsium and Rubidium by means of Lepidollte.—Lecoq de Boisbaudran.—This mineral is acted upon by fluorhydric acid, and the cæsium and rubidium having been separated from the other constituents of the mineral (lepidolite) by well known methods, are isolated by making use of the difference of solubility of the bitartrates of these metals.

La Revue Scientifique de la France et de l'Etranger, August 3, 1872.

This number contains no original papers relating to chemistry, but we quote the titles of the following important memoirs:—

Development of Submarine Telegraphy.—E. Saigey.

Constitution and Movements of Glaciers.—Ch. Grad.

August 10, 1872.

This number contains no original papers relating to chemistry. We call attention to the following lecture:—

Vegetable Products.—Dr. G. Ville.—The continuation of the author's discourses on practical agriculture in the experimental field near Vincennes.

PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1044. W. R. Lake, Southampton Buildings, London, "Improvements in the manufacture of pulp from vegetable fibres for making paper and other materials."—A communication from G. Swift, San Francisco, California, U.S.A.—Petition recorded April 8, 1872.

2261. W. E. Gill, Salisbury Street, Strand, W.C., "Improvements in treating vegetable juices, and in the apparatus and materials to be employed therefor."

2262. T. R. Crampton, Great George Street, Westminster, "Improvements in the manufacture of gas and fuel, and in apparatus to be used for this purpose."

2265. A. M. Clark, Chancery Lane, "Improvements in the manufacture of phosphoric acid and acid phosphate of lime, and the applications of the same."—A communication from L. H. Blanchard, Paris.—Petition recorded July 27, 1872.

2277. E. P. H. Vaughan, F.C.S., Chancery Lane, "Improvements in the treatment of phosphates of lime."—A communication from A. Striedter, Paris.

2279. J. Brown, Edinburgh, "Improvements in the treatment of sewage and in the manufacturing of manures."

2282. G. Haseltine, Southampton Buildings, London, "An improved process of converting cast-iron into steel."—A communication from T. H. Alexander, Washington, U.S.A.—Petitions recorded July 30, 1872.

2287. P. A. Dormoy and F. A. Paget, Adelphi, W.C., "Improvements in puddling furnaces."—Petition recorded July 31, 1872.

NOTICES TO PROCEED.

865. J. Werner, Mannheim, Baden, "An improved composition to be used as a substitute for 'brewers' pitch' for lining vats, casks, and tubs, and for other like purposes."—Petition recorded March 21, 1872.

908. G. J. Snelus, Dowlais, Glamorganshire, "An improved lining for cupola furnaces, also applicable to the formation of the beds of reverberatory furnaces."—Petition recorded March 25, 1872.

943. A. Beveridge, Leith, N.B., "Improvements in preparing, cleansing, and refining animal fats, and in the means and apparatus employed therefor."—A communication from A. Jurgens, Oss, North Brabant, Holland.—Petition recorded March 30, 1872.

971. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in liqueurs or cordials and other beverages, and in apparatus to be employed in their manufacture."—A communication from F. A. Joannon, Paris.

979. W. R. Lake, Southampton Buildings, London, "An improved compound for cleansing carpets and other woven fabrics."—A communication from L. Stern, Boston, Mass., U.S.A.—Petitions recorded April 9, 1872.

1051. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of animal and vegetable substances."—A communication from W. Adamson, Philadelphia, Penn., U.S.A.—Petition recorded April 9, 1872.

1376. D. G. Fitzgerald, Brixton, Surrey, and B. C. Molloy, of Elm Court, Temple, Middlesex, "Improvements in heating compound substances by the agency of electricity, and thereby decomposing them or resolving them into their components, and in apparatus employed therein."—Petition recorded May 6, 1872.

2006. G. Noble, Woodford Bridge, Essex, "Improvements in the method of treating various kinds of fibrous materials for the manufacture of writing, printing, and other paper."—Petition recorded July 3, 1872.

2156. F. J. Cheesbrough, Liverpool, "Improvements in evaporating and concentrating sulphuric and other acids, also salt, sulphur, and other substances capable of evaporation, and in the apparatus to be used therein."—A communication from W. T. Clough, Newark, Essex, New Jersey, U.S.A.—Petition recorded July 18, 1872.

2186. G. Thom, Chorley, Lancashire, and J. Stenhouse, Pentonville, London, "Improvements in treating fatty substances containing colouring matters, and in obtaining useful products therefrom."—Petition recorded July 22, 1872.

2263. G. T. Bousfield, Sutton, Surrey, "Improvements in furnaces for deoxidising iron ores preparatory to their being worked into wrought-iron."—A communication from J. Wilson, Dover, New Jersey, U.S.A.—Petition recorded July 29, 1872.

PATENTS SEALED.

425. R. F. Smith, Glasgow, N.B., "Improvements in obtaining yellow and red prussiates."

429. W. Ireland, Macclesfield, Cheshire, and J. Ireland, Manchester, "Improvements in the manufacture of cast or Bessemer steel ingots."—A communication from R. Pink, Hoerde, Westphalia.—Dated February 10, 1872.

454. F. H. Warlich, Camberwell, Surrey, "Improvements in the manufacture of artificial fuel, and in apparatus to be used for this purpose."—Dated February 13, 1872.

606. S. T. Vanel, Paris, "A new composition and process for waterproofing all sorts of tissues, linen, paper, and other materials."—Dated February 26, 1872.

752. E. Watteeu, Middlesboro'-on-Tees, Yorkshire, "Improvements in explosive compounds."—A communication from A. de Terré, and E. de Mercader, Liége, Belgium.—Dated March 12, 1872.

1080. J. J. Bodmer, Hammersmith, Middlesex, "Improvements in the manufacture of iron and steel."—Dated April 11, 1872.

1409. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of ores, more particularly iron ore, for the manufacture of cast-iron, wrought-iron, and steel therefrom, and in the apparatus to be employed therein."—A communication from La Société Metallurgique pour l'Exploitation des Procédés Ponsard, Paris.—Dated May 8, 1872.

1799. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of iron."—A communication from W. Sellers, Philadelphia, Penn., U.S.A.

1801. G. Haseltine, Southampton Buildings, London, "Improvements in the manufacture of iron and steel, and in apparatus employed therefor."—A communication from J. W. Middleton, Philadelphia, Penn., U.S.A.—Dated June 14, 1872.

1837. T. Hampton, Ickles, near Rotherham, Yorkshire, "Improvements in the manufacture of Bessemer steel ingots."—Dated June 18, 1872.

NOTES AND QUERIES.

Pure Aluminum.—Can your readers inform me of an easy way by which I could procure pure aluminum in the laboratory as an experiment?—E. PURDON.

Lamp for Water Oven.—Can any of your readers inform me of the best sort of lamp to use for a water-oven? I cannot get gas, and spirit of wine is too expensive, as I sometimes keep it going all night, and common oil makes a black mess with the soot that forms.—ALBION.

Powerful Galvanic Battery.—In Mr. Highton's description of a Powerful Galvanic Battery, I do not understand the instructions with respect to the arrangement for the "negative." Should feel obliged if Mr. Highton, or some of your readers, would give a little further explanation on the subject.—H. HARGREAVES.

Powerful Galvanic Battery.—Wou'd Mr. Highton kindly give practical working directions for the construction of the battery described by him, and add information on the following points:—(1) Resistance compared with Grove or Bunsen; (2) comparative tendency to polarisation; (3) constancy and duration of action?—R. T. C.

Hydrocyanate of Morphia, &c.—(1). What is the best plan for making a true hydrocyanate of morphia? I have reason to fear that the hydrocyanate of morphia of Dr. J. M. Maisch (CHEMICAL NEWS, vol. xxiii., p. 310) is nothing but pure morphia. (2). Does the hydrocyanate of bismuth exist; if so, how is it obtained? (3). What is the best method to preserve meat by means of carbolic acid instead of common salt?—J. H. L. SCHUMANN, Murraysburg, Colony of the Cape of Good Hope.

Test for Pure Anthracen.—Can you or any of your readers give a simple and reliable test for the quantity of pure anthracen in a commercial sample of crude? I find those at present in use, viz., alcohol, methylated spirit, and bisulphide of carbon, all, the latter especially, dissolve a considerable portion of the anthracen, thereby causing the result to be very unsatisfactory. Now that this article has some commercial importance, an easily applied test, and one that would be free from doubt, is of considerable importance to tar distillers.—D. G.

Detection of Turmeric in Mustard.—In an article on the "Detection of Adulteration" in the "English Mechanic" of the 9th inst., Mr. A. H. Allen describes the following improved modification of the boracic acid test for turmeric:—"Shake half a teaspoonful of the mustard in the cold with two or three times its bulk of methylated spirits. Filter the solution, and evaporate the liquid to dryness at a steam heat in a porcelain basin, in which is placed a piece of filter-paper about the size of a penny. When all the alcohol has been driven off, moisten the paper with a strong aqueous solution of boracic acid, and again evaporate completely. In presence of turmeric the paper will acquire a reddish colour; but, as a further proof, drop on it some solution of caustic potash or soda, which will produce a very beautiful series of colours, in which green and purple are most evident. On then adding hydrochloric acid, a red colour will be produced, which can be again turned green and blue by addition of excess of alkali. The colours are very vivid and characteristic, pure mustard giving no such result. . . . . Gamboge may be detected in the same way as turmeric, but gives a bright red instead of a green or blue colour on treatment with caustic soda, and on adding excess of hydrochloric acid the paper becomes merely yellow instead of the orange-red colour produced in presence of turmeric."

TO CORRESPONDENTS.

J. Cox.—Received, with thanks.

W. F. D.—You will find the original description in *Comptes Rendus*, January 15, 1872, and *Journal de Pharmacie et de Chimie*, March, 1872.

Mediocrity.—(1). Cannot say. (2). No. (3). Enquire at the British Museum. (4). Very little. (5). Cannot say.

NOTICE TO AMERICAN SUBSCRIBERS.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 665.

BRITISH ASSOCIATION
FOR THE
ADVANCEMENT OF SCIENCE.

Brighton Meeting, August 14, 1872.

INAUGURAL ADDRESS OF THE PRESIDENT,

William B. Carpenter, M.D., LL.D., F.R.S.,
Registrar of the University of London.

(Concluded from p. 77).

And now, having studied the working action of the human intellect in the scientific interpretation of Nature, we shall examine the general character of its products; and the first of these with which we shall deal is our conception of *matter* and of its relation to *force*.

The psychologist of the present day views matter entirely through the light of his own consciousness: his idea of matter in the abstract being that it is a "something" which has a permanent power of exciting sensations; his idea of any "property" of matter being the mental representation of some kind of sensory impression he has received from it; and his idea of any particular kind of matter being the representation of the whole aggregate of the sense-perceptions which its presence has called up in his mind. Thus, when I press my hand against this table, I recognise its unyieldingness through the conjoint medium of my sense of touch, my muscular sense, and my mental sense of effort, to which it will be convenient to give the general designation of the tactile sense; and I attribute to that table a *hardness* which resists the effort I make to press my hand into its substance, whilst I also recognise the fact that the force I have employed is not sufficient to move its mass. But I press my hand against a lump of dough; and finding that its substance yields under my pressure, I call it *soft*. Or again, I press my hand against this desk; and I find that, although I do not thereby change its *form*, I change its *place*; and so I get the tactile idea of *motion*. Again, by the impressions received through the same sensorial apparatus, when I lift this book in my hand, I am led to attach to it the notion of *weight*, or ponderosity; and by lifting different solids of about the same size, I am enabled, by the different degrees of exertion I find myself obliged to make in order to sustain them, to distinguish some of them as *light*, and others as *heavy*. Through the medium of another set of sense-perceptions, which some regard as belonging to a different category, we distinguish between bodies that *feel* "hot" and those that *feel* "cold;" and in this manner we arrive at the notion of differences of temperature. And it is through the medium of our tactile sense, without any aid from vision, that we first gain the idea of *solid form*, or the three dimensions of space.

Again, by the extension of our tactile experiences, we acquire the notion of *liquids*, as forms of matter yielding readily to pressure, but possessing a sensible weight which may equal that of solids: and of *air*, whose resisting power is much slighter, and whose weight is so small that it can only be made sensible by artificial means. Thus, then, we arrive at the notions of *resistance* and of *weight* as properties common to all forms of matter; and now that we have got rid of that idea of light and heat, electricity and magnetism, as "imponderable fluids," which used to vex our souls in our scientific childhood, and of which the popular term "electric fluid" is a "survival," we accept these properties as affording the practical distinction between the "material" and the "immaterial."

Turning, now, to that other great portal of sensation, the sight, through which we receive most of the messages sent to us from the universe around, we recognise the same truth. Thus it is agreed alike by physicists and physiologists, that *colour* does not exist *as such* in the object itself, which has merely the power of reflecting or transmitting a certain number of millions of undulations in a second; and these only produce that affection of our consciousness which we call colour, when they fall upon the retina of the living percipient. And if there be that defect, either in the retina or in the apparatus behind it, which we call "colour-blindness" or Daltonism, some particular hues cannot be distinguished, or there may even be no power of distinguishing any colour whatever. If we were all like Dalton, we should see no difference, except in form, between ripe cherries hanging on a tree, and the green leaves around them; if we were all affected with the severest form of colour-blindness, the fair face of Nature would be seen by us as in the chiaroscuro of an engraving of one of Turner's landscapes, not as in the glowing hues of the wondrous picture itself. And in regard to our visual conceptions, it may be stated with perfect certainty, as the result of very numerous observations made upon persons who have acquired sight for the first time, that these do *not* serve for the recognition even of those objects with which the individual had become most familiar through the touch, until the two sets of sense-perceptions have been co-ordinated by experience.*

When once this co-ordination has been effected, however, the composite perception of form which we derive from the visual sense alone is so complete, that we seldom require to fall back upon the touch for any further information respecting that quality of the object. So, again, while it is from the co-ordination of the two dissimilar pictures formed by any solid or projecting object upon our two retinæ, that (as Sir Charles Wheatstone's admirable investigations have shown) we ordinarily derive through the sight alone a correct notion of its *solid* form, there is adequate evidence that this notion, also, is a mental *judgment* based on the experience we have acquired in early infancy by the consentaneous exercise of the visual and tactile senses.

Take, again, the case of those wonderful instruments by which our visual range is extended almost into the infinity of space, or into the infinity of minuteness. It is the mental, not the bodily eye, that takes cognisance of what the telescope and the microscope reveal to us. For we should have no well-grounded confidence in their revelations as to the *unknown*, if we had not first acquired experience in distinguishing the true from the false by applying them to *known* objects; and every interpretation of what we see through their instrumentality is a *mental judgment* as to the probable form, size, and movement of bodies removed by either their distance or their minuteness from being cognosced by our sense of touch.

The case is still stronger in regard to that last addition to our scientific *armamentum*, which promises to be not inferior in value either to the telescope or the microscope; for it may be truly said of the spectroscope, that it has not merely extended the range of our vision, but has almost given us a new sense, by enabling us to recognise distinctive properties in the chemical elements which were previously quite unknown. And who shall now say that we know all that is to be known as to any form of matter; or that the science of the *fourth* quarter of this century

* Thus, in a recently recorded case in which sight was imparted by operation to a young woman who had been blind from birth, but who had nevertheless learned to work well with her needle, when the pair of scissors she had been accustomed to use was placed before her, though she described their shape, colour, and glistening metallic character, she was utterly unable to recognise them *as scissors* until she put her finger on them, when she at once named them, laughing at her own stupidity (as she called it) in not having made them out before.

may not furnish us with as great an enlargement of our knowledge of its properties, and of our power of recognising them, as that of its *third* has done?

But, it may be said, is not this view of the material universe open to the imputation that it is "evolved out of the depths of our own consciousness"—a projection of our own intellect into what surrounds us—an *ideal* rather than a *real* world? If all we know of matter be an "intellectual conception," how are we to distinguish this from such as we form in our dreams?—for these, as our laureate no less happily than philosophically expresses it, are "true while they last." Here our "common sense" comes to the rescue. We "awake, and behold it was a dream." Every healthy mind is conscious of the difference between his waking and his dreaming experiences; or, if he is now and then puzzled to answer the question "Did this really happen, or did I dream it?" the perplexity arises from the consciousness that it *might* have happened. And every healthy mind, finding its own experiences of its waking state, not only self-consistent, but consistent with the experiences of others, accepts them as the basis of his beliefs, in preference to even the most vivid recollections of his dreams.

The lunatic pauper who regards himself as a king, the asylum in which he is confined as a palace of regal splendour, and his keepers as obsequious attendants, is so "possessed" by the conception framed by his disordered intellect, that he *does* project it out of himself into his surroundings; his refusal to admit the corrective teaching of common sense being the very essence of his malady. And there are not a few persons abroad in the world who equally resist the teachings of educated common sense whenever they run counter to their own preconceptions; and who may be regarded as—in so far—affected with what I once heard Mr. Carlyle pithily characterise as "diluted insanity."

It has been asserted, over and over again, of late years, by a class of men who claim to be the only true interpreters of Nature, that we know nothing but matter and the laws of matter, and that force is a mere fiction of the imagination. May it not be affirmed, on the other hand, that while our notion of *matter* is a conception of the intellect, *force* is that of which we have the *most* direct—perhaps even the *only* direct—cognisance? As I have already shown you, the knowledge of resistance and of weight which we gain through our tactile sense is derived from our own perception of *exertion*; and in vision, as in hearing, it is the force with which the undulations strike the sensitive surface, that affects our consciousness with sights or sounds. True it is that in our visual and auditory sensations, we do not, as in our tactile, *directly* cognosce the force which produces them; but the physicist has no difficulty in making sensible to us indirectly the undulations by which sound is propagated, and in proving to our intellect that the force concerned in the transmission of light is really enormous.*

It seems strange that those who make the loudest appeal to experience as the basis of all knowledge should thus disregard the most constant, the most fundamental, the most direct of all experiences; as to which the common sense of mankind affords a guiding light much clearer than any that can be seen through the dust of philosophical discussion. For, as Sir John Hershel most truly remarked, the universal consciousness of mankind is as much in accord in regard to the existence of a real and intimate connection between cause and effect, as it is in regard to the existence of an external world; and that consciousness arises to every one out of his own sense of *personal* exertion in the origination of changes by his individual agency.

Now, while fully accepting the logical definition of cause as the "antecedent or concurrence of antecedents on which the effect is invariably and unconditionally consequent," we can always single out one *dynamical* antecedent—the power which does the work—from the aggregate of *material conditions* under which that power may be distributed and applied. No doubt the term cause is very loosely employed in popular phraseology; often (as Mr. Mill has shown) to designate the occurrence that immediately preceded the effect;—as when it is said that the spark which falls into a barrel of gunpowder is the cause of its explosion, or that the slipping of a man's foot off the rung of a ladder is the cause of his fall. But even a very slightly trained intelligence can distinguish the power which acts in each case, from the conditions under which it acts. The force which produces the explosion is locked up (as it were) in the powder; and ignition merely liberates it, by bringing about new chemical combinations. The fall of the man from the ladder is due to the gravity which was equally pulling him down while he rested on it; and the loss of support, either by the slipping of his foot, or by the breaking of the rung, is merely that change in the material conditions which gives the power a new action.

Many of you have doubtless viewed with admiring interest that truly wonderful work of human design, the Walter printing machine. You first examine it at rest; presently comes a man who simply pulls a handle towards him; and the whole inert mechanism becomes instinct with life, the blank paper continuously rolling off the cylinder at one end, being delivered at the other, without any intermediate human agency, as large sheets of print, at the rate of 15,000 in an hour. Now what is the *cause* of this most marvellous effect? Surely it lies essentially in the power or force which the pulling of the handle brought to bear on the machine from some extraneous source of power,—which we in this instance know to be a steam-engine on the other side of the wall. This force it is which, distributed through the various parts of the mechanism, really performs the action of which each is the instrument; *they* only supply the vehicle for its transmission and application. The man comes again, pushes the handle in the opposite direction, detaches the machine from the steam-engine, and the whole comes to a stand; and so it remains, like an inanimate corpse, until recalled to activity by the renewal of its moving power.

But, say the reasoners who deny that force is anything else than a fiction of the imagination, the revolving shaft of the steam-engine is "matter in motion;" and when the connection is established between that shaft and the one that drives the machine, the *motion* is communicated from the former to the latter, and thence distributed to the several parts of the mechanism. This account of the operation is just what an observer might give who had looked on with entire ignorance of everything but what his *eyes* could *see*; the moment he puts his *hand* upon any part of the machinery, and tries to stop its motion, he takes as direct cognisance, through his sense of the effort required to resist it, of the *force* which produces that motion, as he does through his *eye* of the motion itself.

Now, since it is universally admitted that our notion of the external world would be not only incomplete, but erroneous, if our visual perceptions were not supplemented by our tactile, so, as it seems to me, our interpretation of the phenomena of the universe must be very inadequate, if we do not mentally co-ordinate the idea of force with that of motion, and recognise it as the "efficient cause" of those phenomena,—the "material conditions" constituting (to use the old scholastic term) only "their formal cause." And I lay the greater stress on this point, because the mechanical philosophy of the present day tends more and more to express itself in terms of *motion* rather than in terms of *force*;—to become *kinetics* instead of *dynamics*.

Thus, from whatever side we look at this question,—whether the common sense of mankind, the logical analysis of the relation between cause and effect, or the study of the working of our own intellects in the interpretation of Nature,—we seem led to the same conclusion; that the notion of *force* is one of those elementary forms of thought with which we can no more dispense than we can with

* See Sir John Herschel's "Familiar Letters on Scientific Subjects."

the notion of space or of succession. And I shall now, in the last place, endeavour to show you that it is the substitution of the dynamical for the mere phenomenal idea, which gives their highest value to our conceptions of that order of Nature which is worshipped as itself a god by the class of interpreters whose doctrine I call in question.

The most illustrative, as well as the most illustrious, example of the difference between the mere generalisation of phenomena and the dynamical conception that applies to them, is furnished by the contrast between the so-called laws of planetary motion discovered by the persevering ingenuity of Kepler, and the interpretation of that motion given us by the profound insight of Newton. Kepler's three laws were nothing more than comprehensive statements of certain groups of phenomena determined by observation. The *first*, that of the revolution of the planets in elliptical orbits, was based on the study of the observed places of Mars alone; it might or might not be true of the other planets; for so far as Kepler knew, there was no reason why the orbits of some of them may not be the excentric circles which he had first supposed that of Mars to be. So Kepler's *second* law of the passage of the Radius Vector over equal areas in equal times, so long as it was simply a generalisation of facts in the case of that one planet, carried with it no *reason* for its applicability to other cases, except that which it might derive from his erroneous conception of a whirling force. And his *third* law was in like manner simply an expression of a certain harmonic relation which he had discovered between the times and the distances of the planets, having no more *rational* value than any other of his numerous hypotheses.

Now the Newtonian "laws" are often spoken of as if they were merely *higher generalisations* in which Kepler's are included; to me they seem to possess an altogether different character. For starting with the conception of two *forces*, one of them tending to produce continuous uniform motion in a straight line, the other tending to produce a uniformly accelerated motion towards a fixed point, Newton's wonderful mastery of geometrical reasoning enabled him to show that, if these *dynamical* assumptions be granted, Kepler's *phenomenal* "laws," being necessary consequences of them, must be *universally* true. And while that demonstration would have been alone sufficient to give him an imperishable renown, it was his still greater glory to divine that the fall of the moon towards the earth—that is, the deflection of her path from a tangential line to an ellipse—*is a phenomenon of the same order* as the fall of a stone to the ground; and thus to show the applicability to the entire universe, of those simple dynamical conceptions which constitute the basis of the Geometry of the Principia.

Thus, then, whilst no "law" which is simply *a generalisation of phenomena* can be considered as having any *coercive* action, we may assign that value to laws which express *the universal conditions of the action of a force*, the existence of which we learn from the testimony of our own consciousness. The assurance we feel that the attraction of gravitation *must* act under all circumstances according to its one simple law, is of a very different order from that which we have in regard (for example) to the laws of chemical attraction, which are as yet only generalisations of phenomena. And yet even in that strong assuarnce, we are required by examination of the basis on which it rests, to admit a *reserve* of the *possibility* of something different; a reserve which we may well believe that Newton himself must have entertained.

A most valuable lesson as to the allowance we ought always to make for the unknown "possibilities of nature," is taught us by an exceptional phenomenon so familiar that it does not attract the notice it has a right to claim. Next to the law of the universal attraction of masses of matter, there is none that has a wider range than that of the *expansion of bodies by heat*. Excluding water and one or two other substances, the fact of such expansion might be said to be *invariable*; and, as regards bodies whose gaseous condition is known, the law of expansion can be stated in a form no less simple and definite than the law of gravitation. Supposing those exceptions, then, to be unknown, the law would be *universal* in its range. But it comes to be discovered that water, whilst conforming to it in its expansion from 39½° *upwards* to its boiling-point, as also, when it passes into steam, to the special law of expansion of vapours, is exceptional in its *expansion* also from 39½° *downwards* to its freezing-point; and of this failure in the universality of the law no *rationale* can be given. Still more strange is it, that by dissolving a little *salt* in water, we should remove this exceptional peculiarity; for *sea*-water continues to contract from 39½° downwards to its freezing-point 12° or 14° lower, just as it does with reduction of temperature at higher ranges.

Thus from our study of the mode in which we arrive at those conceptions of the orderly sequence observable in the phenomena of Nature which we call "Laws," we are led to the conclusion that they are human conceptions, subject to human fallibility; and that they *may* or *may not* express the ideas of the great Author of Nature. To set up these laws as self-acting, and as either excluding or rendering unnecessary the power which alone can give them effect, appears to me as arrogant as it is unphilosophical. To speak of *any* law as "regulating" or "governing" phenomena, is only permissible on the assumption that the law is the expression of the *modus operandi* of a governing power.—I was once in a great city which for two days was in the hands of a lawless mob. Magisterial authority was suspended by timidity and doubt; the force at its command was paralysed by want of resolute direction. The "laws" were on the statute book, but there was no power to enforce them. And so the powers of evil did their terrible work; and fire and rapine continued to destroy life and property without check, until new power came in, when the reign of law was restored.

And thus we are led to the culminating point of man's intellectual interpretation of Nature,—his recognition of the unity of the Power, of which her phenomena are the diversified manifestations. Towards this point all scientific inquiry now tends. The convertibility of the physical forces, the correlation of these with the vital, and the intimacy of that *nexus* between mental and bodily activity, which, explain it as we may, cannot be denied, all lead upward towards one and the same conclusion; and the pyramid of which that philosophical conclusion is the apex, has its foundation in the primitive instincts of humanity.

By our own remote progenitors, as by the untutored savage of the present day, every change in which human agency was not apparent was referred to a particular animating intelligence. And thus they attributed not only the movements of the heavenly bodies, but all the phenomena of Nature each to its own Deity. These Deities were invested with more than human power; but they were also supposed capable of human passions, and subject to human capriciousness. As the uniformities of nature came to be more distinctly recognised, some of these Deities were invested with a dominant control, while others were supposed to be their subordinate ministers. A serene majesty was attributed to the greater gods who sit above the clouds; whilst their inferiors might "come down to earth in the likeness of men." With the growth of the scientific study of Nature, the conception of its harmony and unity gained ever-increasing strength. And so among the most enlightened of the Greek and Roman philosophers, we find a distinct recognition of the idea of the unity of the directing mind from which the order of Nature proceeds; for they obviously believed that, as our modern poet has expressed it,—

> "All are but parts of one stupendous whole,
> Whose body Nature is, and God the Soul."

The science of modern times, however, has taken a more special direction. Fixing its attention exclusively on the *order* of Nature, it has separated itself wholly from theology, whose function it is to seek after its *Cause*. In

this, science is fully justified, alike by the entire independence of its objects, and by the historical fact that it has been continually hampered and impeded in its search for the truth as it is in Nature, by the restraints which Theologians have attempted to impose upon its inquiries. But when science, passing beyond its own limits, assumes to take the place of theology, and sets up its own conception of the *order* of Nature as a sufficient account of its *cause*, it is invading a province of thought to which it has no claim, and not unreasonably provokes the hostility of those who ought to be its best friends.

For whilst the deep-seated instincts of humanity, and the profoundest researches of philosophy, alike point to mind as the one and only source of power, it is the high prerogative of science to demonstrate the *unity* of the power which is operating through the limitless extent and variety of the universe, and to trace its *continuity* through the vast series of ages that have been occupied in its evolution.

ON THE

COLLECTION AND ANALYSIS FOR GASEOUS CONSTITUENTS OF SAMPLES OF DEEP SEA-WATER.*

By W. LANT CARPENTER, B.A., B.Sc., F.C.S.

This paper was a summary of the author's experience on this subject in the "Porcupine" expeditions of 1869 and 1870. Many of the descriptions of apparatus employed, and of the conclusions from long series of analyses of 1869, had appeared in the *Proceedings of the Royal Society* for 1870. The analyses made in the summer of 1870 tended to confirm, in most points, those of 1869, and showed in addition that both surface and bottom waters contained more carbonic acid and less oxygen in the more southern than in the more northern latitudes. The examinations extended from the latitude of the Faroe Isles to that of Lisbon.

The main object of the paper, however, was to show that, contrary to the general supposition on the subject, there was no greater quantity of dissolved gaseous constituents in the bottom than in the surface water; and the author supported his position (which was generally accepted in the discussion which followed) by his own observations, and also by theoretical arguments, against such supposed excess, especially enquiring where the source of it was, while he fully admitted the power of the pressure at great depths to retain it in solution if it once were evolved there.

ON THE

PRESENCE OF ALBUMEN IN NEUTRAL FATS, AND A NEW METHOD OF OBTAINING STEARIC AND PALMITIC ACIDS.*

By W. LANT CARPENTER, B.A., B.Sc., F.C.S.,

In the International Exhibition of 1871 there were exhibited several specimens of stearic acid, &c., by Professor J. C. A. Bock, of Copenhagen. It was stated that they were produced by a new process, which possessed very many advantages over any other known method. The author of this paper, having twice visited Copenhagen to study the process, and having extended its application to neutral fats other than tallow, in England, thought that an account of the scientific aspects of it might not be uninteresting to members of the Section. The inventor, Professor and State Councillor Bock, of Copenhagen, was by profession a medical man, formerly attached to the Danish Court, and a man of high culture and education, though but little known in England. He had been led up to his invention by patient microscopical and chemical study of the properties of neutral fats, and reflection upon the reasons of the disadvantages of methods hitherto practised. These disadvantages Mr. Carpenter pointed out at some length in his paper. Hitherto, when fats were decomposed by alkali, a considerable excess of alkali above the theoretical quantity was required, unless the operation were conducted under very great pressure, when the risk of explosion was great. When they were decomposed by sulphuric (or any other strong) acid, as was usually the case in England, much of the fat was lost by being charred and burnt, and the remainder was so black that it was necessary to distil it to render it good enough in colour for manufacturing purposes. The risk of fire, and of explosion in this operation was considerable, and the expense great. Professor Bock had shown that most neutral fats were made up of minute globules of fat, surrounded by albuminous envelopes, which form 1 to 1·5 per cent of the weight of the fat, and he considered that the excess of alkali, of pressure, or of heat required to decompose fats, was really used in the destruction and removal of these albuminous envelopes, which also attracted to themselves the colouring matters contained in the fat, or produced therein during its decomposition. The existence of the albumen could be demonstrated in the laboratory by dissolving the fat in ether or benzol, and precipitating the solution by water, or by boiling the fat on a *strong* solution of oxalic acid. In both cases the albuminous envelopes collected at the plane of junction of the two liquids. In Professor Bock's process the albuminous envelopes were broken and partly destroyed by the action, for a limited time, and at a given temperature, of a small quantity of strong sulphuric acid. The neutral fat then poured out from the envelopes in a state ready for decomposition by water in open tanks, an operation which required several hours for its complete performance. Its progress was judged of by microscopical examination of the crystals of the fat, or fatty acid, coformed by slowly cooling a thin layer upon a glass slip. When it was completed, the glycerine, which was dissolved in the water used for the decomposition, was drawn off, purified, and concentrated for sale. The fatty acids, amounting to 94 per cent of the original fat, were at this stage of a very brown or blackish colour. The next operation was to eliminate the albuminous envelopes, and with them most of the colouring matters. This was done by submitting the fatty acids in open tanks to the action of dilute solutions of certain oxidising agents, by which the black matters were partly oxidised, and their specific gravity greatly increased, so that when the oxidation had proceeded far enough they readily subsided to the bottom of the tank, leaving the fatty acids comparatively good in colour.* After two or three washings with dilute acid and water, the fatty acids were cold pressed and hot pressed in the usual way, and the result was a stearic acid higher in melting-point and greater in quantity than could be produced in any other way, and an oleic acid excellently fitted for the manufacture of soap and other purposes. One of the greatest advantages of the process was, that all operations were conducted in open tanks, boiled with steam not exceeding 35 lbs. pressure.

Mr. Carpenter stated that he was at present engaged in applying this process to palm oil and other vegetable fats, and he illustrated his paper with specimens of the various stages of manufacture.

Abstract of a Paper read before the British Association, Brighton Meeting, Section B.

* The oxidising agents that had been employed were—the three strong mineral acids, sulphuric, nitric, and hydrochloric, permanganate and bichromate of potash and hypochlorite of lime.

PURE WROUGHT-IRON.

It has hitherto been deemed impossible to make pure wrought-iron; this has recently been done on a large commercial scale at the Bowling Iron-Works, Bradford, by the Henderson process. The analysis of the pig-iron used is—

Graphitic carbon	3·155
Combined carbon	0·581
Silicon	1·646
Sulphur	0·070
Phosphorus	0·635
Manganese	1·472
Iron	92·644
	100·203

The wrought-iron from the above analyses—

	Per cent.
Carbon	0·272
Silicon	none
Sulphur	the barest trace
Phosphorus	none
Manganese	none
Iron, by direct determination	99·500
	99·772

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 67.)

I shall now call your attention to three commercial preparations of indigo, obtained by the action of sulphuric acid on it. The first is called *sulpho-purpuric acid* or *phenicine*, which is made by adding 1 part of indigo to 4 parts of highly concentrated sulphuric acid, heating for a short time, varying from half-an-hour to an hour, or until a small quantity of it mixed with a large quantity of water gives a deep purple colour. Great care must be bestowed on this part of the operation, so as to avoid the formation of a compound, to which I shall have again to call your attention, *sulpho-indigotic acid*. The acid mass produced is thrown into about 40 or 50 parts of water, when a beautiful purple precipitate is produced, which is collected on a filter, and slightly washed with weak muriatic acid. To dye wool with this sulpho-purpuric acid it is necessary to add to the bath a little muriatic acid, when it yields to the wool a fine dark purple-blue, that can be converted into various shades of purple by passing the wool so dyed in a bath containing a small quantity of carbonate or acetate of soda, which removes a small quantity of sulpho-indigotic acid that may be present, and gives rise to *sulpho-purpurate of soda*, which is a faster dye than the acid itself.

Sulpho-indigotic Acid is manufactured by dissolving 1 part of indigo in 10 or 12 parts of concentrated sulphuric acid, and heating the whole at a temperature of 120° F. very carefully for some hours. The operation is completed when a small quantity dissolves entirely in cold water.

The acids above described, when obtained perfectly pure, have the following formulæ:—Sulpho-purpuric acid, $C_{16}H_{10}N_2O_2,SO_3$; sulpho-indigotic acid, C_8H_5NO,SO_3.

Berzelius admits a third compound, called *hypo-sulpho indigotic acid*. These acids are transformed into neutral salts of soda, and sold under the names of neutral paste and carmine of indigo. They are prepared by neutralising the sulpho-acids with carbonate of soda, and the paste so formed is thrown on a wooden filter to remove the sulphate of soda which it contains, as well as a green colouring-matter, which is doubtless modified chlorophyl. The paste is then washed with a solution of chloride of sodium. It is a curious fact that carmines of indigo, which are perfectly soluble in pure water, are altogether insoluble in water containing either sulphate of soda or chloride of sodium.

Whilst speaking of the sulpho-indigotates, it may be useful to notice that the sulpho-indigotates of potash and soda are soluble in 100 to 150 parts of water, the sulpho-indigotates of lime, magnesia, and alumina are freely soluble, whilst those of baryta and lead are insoluble.

The carmines of indigo are especially used by silk-dyers, in consequence of the removal of the green colouring-matter above referred to, and which, if allowed to remain, would spoil the blue or purple which they wish to obtain. The method practically adopted to ascertain if the sample has been well washed, consists in rubbing a small quantity of it on a piece of glazed paper, which, when the colour dries, gives a colour varying from a pale blue to a rich copper purple, according to the mode of manufacture; and if any green colouring-matter is left in, it shows itself as a green ring round the blue circle.

The following may be taken as the composition of a sample of carmine of indigo of fair quality:—

Water	85·0
Indigo	10·2
Saline residue	4·8
	100·0

The sulpho-indigotic acids are especially used by woollen dyers, who add to the dye-beck a little alum and cream of tartar, which helps the fixing of the indigo on the wool. The green colouring-matter is in this case not objectionable, having no affinity for the fibre of wool.

The carmines of indigo, as well as the sulpho-acids, are easily decolourised by reducing agents, such as hydrogen and sulphuretted hydrogen, but they gradually reassume their original colour when exposed to the atmosphere, through the absorption of oxygen.

The above compounds, not being suitable for dyeing cotton, and not giving colours on silk and wool that may be considered fast, I shall now proceed to describe a few of the methods followed to obtain fast indigo blues. They are all based on the principle of the reduction of blue indigo into white indigo. The latter compound is held in solution by an alkali, which enables the dyer or printer to introduce it into the fibre of the fabric, where, on exposure to the atmosphere, the alkali combines with carbonic acid, and the white indigo thus liberated absorbs oxygen, and becomes insoluble blue indigo. The principal class of goods to which this chemical reaction is applied is to the vegetable fibres, linen, and especially cotton. As far as dyeing is concerned, the processes can be classed under two heads, hot and cold. The hot process is principally applied to wool, the cold to vegetable fibres, especially cotton.

The oldest and still most generally employed method of preparing cold vats, consists of putting into a vat containing about 2000 gallons of water, 60 lbs. of indigo, very finely powdered, 180 lbs. of slaked lime, and 120 lbs. of sulphate of protoxide of iron or green vitrol (free from any trace of copper salt), the two latter substances being added from time to time. The greater part of the lime used unites with the sulphuric acid of the iron salt, to produce sulphate of lime or gypsum, and the liberated protoxide of iron removes the oxygen from the indigo, becoming converted into saline oxide, whilst the reduced indigo dissolves in the excess of lime employed.

Messrs. R. Schloesser and Co., of Manchester, have introduced within the last year or two a marked improvement in the preparation of cold vats, which removes the great objections of the bulky precipitate of

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

sulphate of lime, the formation of an oxide of iron, and the loss of indigo by its combination with the oxide of iron referred to in the previous part of the lecture. The bath remaining much more fluid, the pieces are less apt to be spotted, and a better class of work is produced. To carry out their process, they add to the ordinary 2000 gallon vat 20 lbs. of ground indigo, 30 lbs. of iron borings, 30 lbs. of their remarkable powdered zinc, and 35 lbs. of quick-lime; the whole is stirred up from time to time for 24 hours, when it is ready for use. If the bath is not considered sufficiently strong, a little more lime and zinc are introduced.

The chemical theory of the process is, that the zinc, under the influence of the lime, decomposes water, combining with its oxygen, and the hydrogen thus liberated, removes oxygen from the indigo, which then dissolves in the lime.

To dye cotton yarn in the above vats, it is simply necessary to dip it for a few minutes in the dye-bath, and expose it to the atmosphere, when the green hue it has acquired passes rapidly into blue. This operation is repeated until the yarn has attained the required depth of shade, when it is passed into weak vitriol, washed, and is ready for market.

To dye calicoes, the pieces are hooked on frames, passed through a bath of weak milk of lime, and then dipped into the reduced indigo vat. After fifteen minutes, the frame is taken out, and the cloth exposed to the air for about the same length of time. It is again dipped, the process being repeated until the required depth of tint is attained. It is then passed through weak vitriol, and washed. The cold vats are especially used when it is wished to obtain white and yellow designs on a blue ground; but when the object in view is to produce a self-colour, a more rapid process is adopted. This consists in passing the pieces through a dye-beck, then through an acid liquor, and lastly in water, by means of rollers fixed in the vat. The bath is composed of lime, sulphate of iron, and indigo, but is kept hot, instead of cold as in the former case.

There is still another process, which is now used to a limited extent only, but was at one time very extensively employed. It produces on the cloth a pale blue which has a great similarity of tint to that seen on the china porcelain, from which it derives its name of china-blue. To produce it the pieces are printed with a mixture containing very finely-powdered indigo, and a little acetate of iron, and are made to pass through six successive vats. The first two contain lime, the third sulphate of iron, the fourth a solution of caustic soda, the fifth a dilute solution of sulphuric acid, and the sixth water. When the design has acquired the required depth of blue, the pieces are washed, passed once more through weak sulphuric acid, and again washed. The chemical reactions are exactly similar to those in the cold vat process.

For dyeing wool, a modification of the old woad vat is employed. The use of woad being now almost entirely discontinued, I shall merely call your attention to the process in which indigo has been substituted for woad. It bears the name of Indian vat, doubtless from the process having been practised in India and imported from thence. It is as follows:—8 lbs. of powdered indigo is added to a bath containing 3½ lbs. of bran, 3½ lbs. of madder, and 12 lbs. of potash, which is maintained for several hours at a temperature of 200° F. It is then allowed to cool to 100° F., when fermentation ensues. After about 48 hours, the indigo is rendered soluble, being reduced, by the decomposition of the sugar and other products contained in the bran and the madder-root during the process of fermentation. The bath should have a greenish yellow appearance, having a frothy scum of a blue coppery hue.

Of late years, improvements have been made in this class of vats, by which the expense of using madder is avoided. They are now prepared by adding to water, at a temperature of 200° F., 20 buckets of bran, 26 lbs. of soda crystals, 12 lbs. of indigo, and 5 lbs. of slaked lime. After 5 hours, the bath is allowed to cool to 100° F., when fermentation ensues, and the indigo is dissolved in the alkali. The management of these vats require great experience and care, for if the fermentation is too slow, the indigo is not properly reduced, whilst if too active large quantities of indigo may be lost. The researches of Dr. Schunck, already referred to, not only show the method of avoiding this loss, but explain why it occurs. The remarks which I made as to the causes of failure in the manufacture of indigo are applicable here, namely, that if the fermentation becomes alcoholic and acetic, the non-oxidisable indigo compounds described by Dr. Schunck are generated.

I cannot leave the subject of indigo without bringing before you a most curious source of its production, namely, the human body. Medical men had observed from time to time that urine, secreted under certain pathological conditions, became brown, and sometimes even blue, when exposed to the atmosphere. The late Dr. Hassel discovered that in some instances the colouring matter was indigo, but here, again, we are indebted to Dr. Schunck for much information on the subject. In three papers presented to the Royal Society, he has proved that urine, in cases similar to those examined by Dr. Hassel, contained the glucoside of indigo, or indican. He also observed that indican was a very frequent constituent of urine secreted by persons in a healthy state, and, in fact, that it is produced generally when persons do not take sufficient exercise, and he has on several occasions succeeded in producing it by taking in his food a rather large excess of sugar.

(To be continued).

ON THE

EVIL EFFECTS OF THE USE OF ARSENIC IN CERTAIN GREEN COLOURS.*

By FRANK W. DRAPER, M.D.

(Continued from p. 54).

But in studying the reported cases of wall-paper poisoning, we need not confine our selections to observations made in other countries. Abundant testimony is afforded in our own midst; and this fact, that the pernicious effects of using the arsenical paper-hangings have been recognised and experienced here, and that cases have repeatedly occurred demonstrating the susceptibility and exposure of our own people, is of obvious importance and possesses a value which investigations at a distance could hardly be thought to have in comparison. The following are some of the instances which have been observed in this community:—

A well-marked case of poisoning occurred in 1863 in Boston, and was reported by Dr. W. E. Rice. The patient was a woman aged seventy-five years. After living a few days in a room which had had been papered with a bright green paper, she was attacked with a burning sensation in the throat and stomach, with frequent, though slight, vomiting after taking food. She had diarrhœa, with some dysenteric discharges; there was also great weakness, with trembling of the limbs and loss of appetite. Subsequently, severe cramps came on in the stomach and bowels; the skin was clammy; the voice was altered; pulse 100; bowels constipated; abdomen very tender on pressure. There was violent retching and vomiting on taking small quantities of either liquid or solid food. All these symptoms were much aggravated after sweeping or dusting the room. Proper treatment alleviated the distress; but when the room was again dusted, the symptoms recurred with renewed violence. The residence of the patient was now changed, and recovery followed. The paper was found,

* From the "Third Annual Report of the State Board of Health of Massachusetts."

on examination, to contain arsenite of copper in its pigment.*

The notes of the following case were communicated to the writer by the individual who is the subject of the report:—In the autumn of 1859, a middle-aged lady, the wife of an eminent citizen of Boston, commenced to occupy a room which had been freshly decorated with wall-paper whose pattern consisted of alternate stripes of gilt and green flock; of the poisonous character of the latter she was wholly unaware. Excepting a neuralgia from which she had long suffered, she considered her health at this time to be perfect. Soon after beginning to habitually sit in the apartment she noticed a change in her feelings. The neuralgia, which previously had been only annoying, became intensified. She had headache and vertigo. There was nausea and distressing vomiting. The appetite was impaired; there was a dry cough and a bad taste in the mouth. Marked emaciation was manifest, and an almost intolerable sense of prostration and exhaustion ensued. All these symptoms compelled her to keep the room the more continuously. Remedies were meanwhile applied unavailingly, since the cause of the ailment was not detected. In the following summer, a stay of several months in the country was attended with distinct relief; but a return to the town residence was followed by a renewal of the painful experience, and during the winter months, while the room was occupied, the patient suffered distressingly. A second summer's absence brought a second season of respite, only to be followed by a third attack which renewedly baffled the skill of the attending physician. The symptoms at this period were of the most aggravated character. Frequent attacks of fainting, intense paroxysms of neuralgia, dizziness, almost incessant vomiting, and great prostration reduced the patient to the last extremity, and her life was despaired of. At this time, when the sufferer was almost moribund, it occurred to herself that the possible cause of all her deplorable state was in the green paper of her room. A sample was at once analysed by Dr. A. A. Hayes, and was pronounced by him to be "loaded with arsenic and extremely unsafe." From this discovery was dated the beginning of the patient's recovery. The paper was removed as soon as possible, but so fully had the patient's system become charged with the poison, and so depressing were its primary effects, that the consequences of the renewed infection are experienced to this day.

The colouring matter of the paper had become so loosely adherent that, on passing the hand or a cloth lightly over its surface, a distinct green stain was left. The workman who removed the paper from the walls was made seriously ill, although precautions were taken to prevent that accident; and it was ascertained also that the paper-hanger who had originally applied the paper was similarly poisoned.

Cases might be multiplied almost indefinitely; but it is believed that those which have been cited will suffice to demonstrate the fact that very harmful effects may and do result from the employment of an agent whose poisonous character is well recognised and whose sole recommendation by those who offer it displayed on the paper-hangings which are designed to decorate our walls is that it produces an attractive colour cheaply. These recorded instances exhibit a series of symptoms which, upon analysis, clearly show that the arsenical poisoning impresses itself on the human system locally as well as through its general influence. The local effects are precisely such as would be expected from the continued inhalation of an irritant agent, or from its presence in the atmosphere; the dryness of the throat and mouth, the inflammation of the mucous surface of the eye, the occasional salivation, the husky and altered voice, the severe frontal headache (about the frontal sinuses), the nausea and vomiting, the dry cough, all point to the action more or less marked and immediate on the various surfaces with which the poison comes in contact; while the more prolonged and insidious influence is indicated in the great debility and lassitude, the emaciation, the impaired nervous power, the irritability of disposition and depression of spirits, the muscular trembling, the occasional convulsions, the vertigo, the chilled extremities, the restless sleep, the pale cachectic aspect, the digestive disturbances, and the neuralgia, which comprise the general or constitutional symptoms. It is, of course, obvious that all these phenomena will not manifest themselves in the same individual as the results of exposure; nor will they present the uniformity which characterises other modes of poisoning. Of those in any degree affected, probably the majority would remark only the more primary and insignificant symptoms; for example, after a night's sleep in an apartment with the arsenical paper on its walls, the individual will notice a headache or a dryness of the mouth. It is only after prolonged exposure, or in persons specially susceptible, that the more serious effects are manifested. Thus it is by a careful criticism of the various symptoms presented in a given case, and by observing the fact that in the presence of the assumed cause no other cause can be discovered sufficient to account for these various local and constitutional symptoms, that we are enabled to arrive at definite conclusions. There are no distinct and characteristic effects which will allow the observer at once to discriminate such a case, as salivation enables him to do in mercurial poisoning, or as the blue line of the gums and wrist-drop, in poisoning by lead. It is, indeed, this very obscurity and want of uniformity characterising the effects of chronic arsenical poisoning from the cause in question that has led many writers to question, and not a few to deny, the possibility of the dependence of such a condition on this exposure. It will doubtless also explain the fact that comparatively few of these instances are recognised in their true and independent relation, and are reported as such; for it is plain that only the most unequivocal cases would be likely to see the light through the journals, and we are justified in inferring that a very great number of instances have occurred which, from their anomalous character, have escaped detection.

This feature is of evident importance as affecting the public health. If cases were habitually occurring presenting well-defined signs, and readily traced to their cause, the community would entertain no doubt concerning the course to be followed, and arsenical paper-hangings would very quickly become unfashionable. But the individual instances, like some of those cited, are in many respects perplexing and obscure, readily eluding the tact of the physician in his attempts to determine their true character, and baffling him in the application of his remedies; hence there is a vantage ground for scepticism on the one hand, and for ignorance on the other.

In this connection, it may be observed that the symptoms due to poisoning by arsenical paper-hangings are, notwithstanding the peculiarities above alluded to, strikingly similar to and, in many respects, absolutely identical with, those of chronic arsenical poisoning when the agent, swallowed in small and frequently repeated doses, exerts its cumulative action. These latter symptoms are notoriously varied in character and present many apparent anomalies. They follow little regularity of manifestation. In different individuals, they are exhibited sometimes with most emphasis in the digestive system, sometimes in the nervous system, and sometimes the influence is a general one and shows itself in a complication of symptoms. Thus it will be seen to be unnecessary to define a distinct train of phenomena as peculiar to poisoning by green wall-paper, since these offer no points of essential difference from those observed in ordinary chronic arsenical poisoning. The difference is one of degree, and depends on the more or less prolonged and continuous exposure to small amounts of the poison introduced into the system slowly and by indirect channels.

Although the fact that serious and sometimes very alarming disease follows, in certain cases, the use of arsenical-green wall-paper is of more consequence to the

* *Boston Med. and Surg. Journ.*, vol. lxix. (1863), p. 297.

community at large than any discussion of hypotheses concerning the method of infection, this latter question is not without interest. Various theories have been advanced to explain the processes by which the poisonous pigment enters the system so as to produce its manifold pernicious effects. Gmelin, who first called attention to the subject in any of its relations, was of the opinion that the poison was absorbed as a volatile gas, the product of a "fermentation of the organic matters with which the arsenic is mixed." A little later, M. Louyet, of Brussels, declared that this gaseous exhalation was a special form of arseniuretted hydrogen, and based his theory on the observation that, when a mixture of arsenic and distilled water is allowed to stand a few days, the water at the end of that time gives out a distinct odour of garlic, which, as is well known, is characteristic of arsenic; and this evolution he thinks due to a decomposition of the water in the presence of arsenic. Analogously, the moisture which is almost always present in the walls of rooms undergoes a similar decomposition, evolving a volatile and very poisonous product. This view he thought strengthened by the presence of the alliaceous odour in rooms papered with the arsenical hangings. Basedow, a Prussian chemist of distinction, published similar opinions, the source of danger being attributed by him to the development, under the influence of moisture, of a certain amount of arseniuretted hydrogen. Other observers have adopted similar views, advocating the theory of gaseous decomposition, either from the presence of moisture,* or from slow combustion ("eremacausis") of the organic elements contained in the paper or its pigment,† or from the presence in the room of illuminating gas which escapes in small amount and reacts on the arsenite of copper to produce arseniuretted hydrogen.‡

All these theories of the evolution of a poisonous gas are to be distinguished from the absolutely untenable notion which was at one time accepted popularly, viz., that the poisoning took place by the inhalation of volatile arsenical fumes which escaped from the paper. This idea is obviously fallacious, since arsenic is volatilised and evolves "fumes" at a temperature of 360° F., 150° above the boiling-point of water.

These hypotheses are not accepted by the majority of chemists at the present day. It is the general belief that the poison escapes from the paper into the atmosphere in the form of dust, mechanically disengaged. This view seems not unreasonable in consideration of the composition of the paper and of the methods employed to engage the pigment in position. The connection between the paper and its colour, at the beginning depending only on the adhesiveness of size, certainly does not grow stronger with age. The paper is applied to the wall when moist with the paste or glue of the paper-hanger, and the size surrenders in this process something of its adhesive property. Varying states of the atmosphere, as they regard moisture and dryness, still farther carry on the change by which, with alternate drying and wetting, the pigment is less and less securely held. So that any mechanical violence, however small,—the action of drafts of air, or the passing of a duster, or vibration,—serves to disengage an impalpable powder containing the poisonous agent. It is well known that in the most unused room the air contains a certain amount of dust, so that a single sunbeam let into such a room when it is darkened reveals a perfect cloud of flying particles whose origin no one can tell. It is easy to see how the loosely adherent arsenical powder on the wall-paper of such a room may constitute a part of this dust, and the atmosphere become charged in greater or less degree with the pernicious agent. One element in the vexed problem of the relation of dust and disease thus finds solution.

This view has received confirmation in the fact that the dust resting on the furniture and mantels of such rooms has been tested, and has been found to contain the arsenic in considerable amount.

* Otto Mohr. † John Taylor. ‡ C. T. Jackson.

A third class of observers, including M. Kirchgässer, of Coblentz, and M. Chevallier, accept both these theories and allow a dual toxical influence. They admit all that is claimed for the dust hypothesis, but believe also, in view of the occasional detection of the odour of garlic or of mustiness in the suspected rooms, that under certain conditions of moisture a gas is generated, poisonous in character, which escapes to infect the air.

(To be continued.)

CORRESPONDENCE.

THE BRITISH ASSOCIATION AND THE MECHANICAL EQUIVALENCE OF HEAT.

To the Editor of the Chemical News.

Sir,—In 1870, the British Association paid £50 for experiments on the mechanical equivalence of heat. In 1871, a committee was re-appointed to examine and report on the subject.

The reports, &c., of the Sections were presented to-day, but this committee have made no sign. Surely they ought, in justice, to say what they have done, or what they have not done; what conclusions they have come to, or not come to; to make some statement or other. Section A refused last year to allow me to say anything on the subject: the committee will do nothing for themselves.

It is a very important subject, and it is unjust to stifle it. It seems to me clear that the doctrines enunciated by Professor Tait in his Thermodynamics must, to say the least, be much modified. Why not acknowledge it? I see that Dr. Maxwell, in his very recently published treatise "On Heat," has very much modified or explained away Tait's theory of the absolute zero of temperature.—I am, &c.,

H. Highton.

Brighton, August 15, 1872.

MISCELLANEOUS.

British Association for the Advancement of Science.—The following is a complete list of the papers which were brought before Section B (Chemical Science) at the Brighton meeting, under the presidency of Dr. Gladstone, F.R.S., &c. They will be published, in full or in abstract, according to their importance, in the Chemical News.

The President's Address.

Report of the Committee for Investigating the Chemical Constitution and Optical Properties of Essential Oils used for Perfumes.

Prof. J. W. Mallet.—On the Fusion of Metallic Arsenic.

Prof. J. W. Mallet.—On the effect upon Meteoric Iron as regards the capability of being Forged, of previous heating to redness or whiteness, *in vacuo*.

W. Chandler Roberts.—On a Curve, Illustrating the British Gold Coinage.

W. Lant Carpenter.—On the mode of Collection of Samples of Deep Sea-Water, and of their Analysis for Dissolved Gaseous Constituents.

T. E. Thorpe.—On a New Filter-Pump.

Dr. Moffat.—On the Tube Ozonometer.

C. J. Woodward.—On a Modification of Hofmann's Apparatus for the Electrolysis of Water.

Preliminary Report of the Committee on Siemens's Electrical Resistance Pyrometer.

Report of the Committee for Superintending the Monthly Reports of the Progress of Chemistry.

Dr. Gladstone and Mr. Tribe.—On the Mutual Helpfulness of Chemical Affinity, Electricity, and Heat in the Decomposition of Water.

J. Dewar.—On Specific Heats at High Temperatures.
J. W. Mallet.—On the Occurrence of Native Sulphuric Acid in Texas.
J. W. Mallet.—On the Occurrence in recent Pine Timber of Fichtelite, a hydrocarbon hitherto only known in a fossil state.
W. Weldon.—On the Manufacture of Chlorine by Manganite of Magnesium.
F. C. Calvert.—On the Composition of Bleaching-Powder.
A. Tribe.—On the Precipitation of Silver by Copper.
G. Gladstone.—On the Dust thrown up by Vesuvius in the Recent Eruption.
Dr. Schenck.—On the Amounts of Heat required to Raise Elementary Bodies from the Absolute Zero to their State of Fusion.
W. Lant Carpenter.—On the Presence of Albumen in Neutral Fats, and on a New Process for the Manufacture of Stearic and Palmitic Acids.
J. F. Walker.—On Dinitrobrombenzine.
C. R. A. Wright.—On New Derivatives from Morphine and Codeine.
J. Williams.—Preliminary Note on the Preparation of Gavanine.
J. A. Wanklyn.—On some New Methods of Analysing the Ethers.
Rev. H. Highton.—On a Powerful Galvanic Battery.
Prof. Crum Brown.—On Chemical Nomenclature.
Dr. T. Wood.—On the Teaching of Elementary Chemistry.
Dr. Gladstone.—On Filiform Native Silver.
G. Unwin.—To Exhibit Specimens of Agate and other forms of Natural Colloid Silica.
J. A. Wanklyn.—On the Continuous Production of Oxygen.
J. B. Grantham.—Report on the Utilisation of Sewage.
W. J. Cooper.—On a Proposed Method of Preventing the Fermentation of Sewage. (Discussion on the Report on the Utilisation of Sewage.)
Herr von Rath.—The Crystallographic System of Leucite.
Dr. Ord.—Crystallisation of Salts in Colloid Solutions.
Dr. Oppenheim.—The Action of Phosphorus on Alkaline Solutions of Metals.
John Galletly.—Ignition of Cotton by Saturation with Fatty Oils.
James Howell.—On the Minerals lately Found in the Drainage Works at Brighton. (With Specimens.)

Officers and Committee.

President.—Dr. J. Hall Gladstone, F.R.S., F.C.S.
Vice-Presidents.—F. A. Abel, F.R.S.,; Professor Williamson, F.R.S.; J. H. Gilbert, Ph.D., F.R.S.; Sir Benjamin Brodie, Bart., F.R.S.; Prof. G. C. Foster, F.R.S.
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Place of Meeting for Next Year.—The meeting next year will be held at Bradford, commencing on September 19. President Elect—Dr. James P. Joule, LL.D., D.C.L., F.R.S. Belfast has been selected for the meeting of 1874.

University of London—First B.Sc. and Preliminary Scientific (M.B.) Examinations.—The following are among those who presented themselves for the Examinations for Honours:—*Mathematics and Mechanical Philosophy.*—First Class. J. M. Lightwood, First B.A. (Exhibition), Trinity Hall, Cambridge; R. H. Jude, First B.Sc., Christ's College, Cambridge. Second Class. J. F. Main, First B.Sc., private study. *Chemistry.*—First Class. R. E. Carrington, Prel. Sci. (Exhibition), Guy's Hospital; B. A. Whitelegge, Prel. Sci., University College. Second Class. H. B. Briggs, Prel. Sci., King's College; H. D. Stewart, Prel. Sci., King's College; R. H. Jude, First B.Sc. and Prel. Sci., Christ's College, Cambridge; F. Goodchild, Prel. Sci., Epsom and University Colleges; A. S. Napier, First B.Sc., Owens College; W. B. Worthington, First B.Sc. and Prel. Sci., Owens College. *Organic Chemistry, and Materia Medica and Pharmacentical Chemistry.*—First Class. W. B. Houghton (Exhibition and Gold Medal), University College; H. R. Crocker (Gold Medal), University College; P. T. Duncan, University College. Second Class. A. P. Gould, University College; G. E. Herman, London Hospital.

Fluorescence.—At the meeting of the American Institute, President Henry Morton, of the Stevens Institute of Technology, read a paper on "Fluorescence," or that action by which rays of the higher purple, or even invisible light, such as produce most strongly photographic action, excite in certain bodies lower rates of vibration, resulting in the emission of light, generally of a red, green, or clear blue colour. This paper was illustrated by a number of striking experiments. Thus, a flask of solution of chlorophyl (a green colouring-matter obtained from leaves), which is of an olive-green colour, being held in a beam of blue light proceeding from a "vertical lantern" appeared to be full of a blood-red liquid. Various solutions colourless in ordinary light were then shown to exhibit the brightest hues when illuminated by the violet rays of the lantern, or those obtained from the electrical discharge of the Professor's large coil in rarefied gases. The speaker then announced that in the course of the examination which he had been making of such substances, he had encountered one which he believed to be as yet unknown, and which possessed the property of developing light by fluorescence in a pre-eminent degree. This body was obtained from petroleum, and he would propose to take for it the name "Viridin." The word viridin had been already applied as a synonym for chlorophyl, but was now practically obsolete, and too appropriate to the present substance to be thrown away. A large drawing of a flower, with leaves painted seemingly in light umber tints, was then shown and illuminated by electric discharges, when it appeared of the most vivid green. The peculiar fluorescent spectrum of this body, and its relations to the spectra of other substances, was explained, and many other illustrations were exhibited.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, August 12, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

Mode of Division of One Base between Several Monobasic Acids when together in Aqueous Solution.—Dr. Berthelot.—A physico-chemical essay elucidated by several tables exhibiting results of experiments and theoretical calculations.

Conversion of Dextro-Rotating Tartaric Acid into Racemic Acid.—E. Jungfleisch.—The main gist of this essay is that optically active, or dextro-rotating tartaric acid is, when heated along with water in sealed tubes to 175°, converted almost entirely into racemic

acid. The author has made this experiment on a large scale in a Papin pot made of wrought steel, and enamelled inside, and found that the result is the same when the vessel is carefully heated in an oil-bath up to 180°.

Although not strictly belonging to chemistry, we quote the title of the following memoir:—

Report on the Carboniferous Flora of the Département de la Loire.—M. Grand Eury.—This exhaustive paper is an important contribution to our knowledge of the plants which have been converted into coal.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 14, 1872.

This number contains the following original memoirs and papers:—

Bromated Chlor-Salylic Acid and Bromated Chlorobenzoic Acid.—A. Claus.—After briefly referring to the researches of Drs. Beilstein, Kuhlberg, and Pfeiffer on this subject, the author states that the best method of obtaining the bromated compound of these acids is to treat their silver salts with bromine. The bromated chlor-salylic acid is a solid crystalline body, fusing at 151°, and subliming, without decomposition, at 160°. 1 part of this acid is soluble in 380 parts of water at 21°; most of its salts are also freely soluble in water. The formula is C_7H_4Br,ClO_2. Bromated chlorobenzoic acid is also a solid, crystalline body, more difficultly soluble in water than the former acid (1 part requires, at 0°, 2840, and at 21°, 1080 parts of water for solution); at 160°, this substance also sublimes without decomposition. In the preparation of chlorobenzoic acid from benzoic acid and a mixture of chlorate of potassa and hydrochloric acid a large quantity of dichlorobenzoic acid is formed.

Thio-Isopropyl Alcohol and Isopropyl-Sulphonic Acid.—A. Claus.—After describing at great length the mode of preparation of thio-isopropyl alcohol, it is stated that that substance is a fluid lighter than water, soluble in every proportion in alcohol and ether, and not quite insoluble in water, from which solution the mercury combination of the alcohol is obtained upon the addition of mercuric chloride. Concentrated nitric acid decomposes thio-isopropyl alcohol with violence; but with dilute nitric acid the reaction is moderate, and attended for a few moments by a very brilliant purplish colouration, which disappears, the result of the reaction being the formation of sulphuric acid and a new organic acid. The formula of thio-isopropyl alcohol is C_3H_8S. Isopropyl-sulphonic acid, $C_3H_7.SO.OH$, is the new organic acid alluded to, and a solid crystalline body fusing at below 100°, forming crystalline salts.

Synthesis of Sulphuretted (Geschwefelte) Tannic Acids.—H. Schiff.—Notwithstanding its intrinsic merits, the contents of this lengthy essay, elucidated by a large number of complex formulæ, are not well suited for useful abstraction, an observation also applying to the following paper.

Constitution of Coumarine.—H. Schiff.

Mesoxalic Acid.—J. Ossikovszky and G. Barbaglia.—The authors tried in vain to obtain free mesoxalic acid, by first converting chloroxalic acid ethyl-ether into a cyanogen compound, and next saponifying that body. Every experiment made to convert the cyanogen compound into COOH failed. The authors describe the mode of preparing acetyl-oxaminic acid ethyl-ether, a solid crystalline substance, percentically consisting of—C, 45·28; H, 5·66; N, 8·74. When boiled with water this body is decomposed.

Contribution to our Knowledge on Guanidin.—J. Ossikovszky.—The preparation of guanidin according to Bannow's method, viz., treatment of iodide of cyanogen with three times its weight of alcoholic ammonia solution at 10 per cent in sealed tubes at 100°, does not, according to the author, give quite satisfactory results, only a small quantity of guanidin being obtained after purifying the crude product. By taking up, under the influence of either boiling dilute sulphuric acid or of alkalies, the elements of water, guanidin is split up, yielding first urea and ammonia; the former is again converted into carbonic acid and ammonia by taking up water.

New Method of the Formation of Amides and Nitriles.—E. A. Letts.—This excellent and exhaustive monograph is divided into the following sections:—Action of acetic acid upon sulpho-cyanide of potassium; action of isobutyric acid upon sulphocyanide of potassium; action, respectively, of valerianic, benzoic, cuminic, and cinnamic acids upon sulphocyanide of potassium.

Dimethyl-Anthracen.—A. van Dorp.—The author describes, at length, the synthetical preparation of dimethyl-anthracen, by treating xylyl-chloride with water at a high temperature in a sealed tube. By that operation an oily body is obtained which, when it is passed through red-hot tubes filled with pumice-stone, is converted into dimethyl-anthracen. This material is very like anthracen, and fuses at 200°; when dissolved in glacial acetic acid and oxidised by chromic acid, an oxidation product is obtained which is at present the subject of the author's research.

Crystalline Shape of Hydrate of Chloral.—P. Groth.—A strictly crystallographical memoir.

Contribution to our Knowledge of the Aromatic Addition Products.—C. Graebe.—This monograph is divided into the following sections:—Introduction, containing a general review of the compounds obtained by the addition of hydrogen to the aromatic compounds; naphthalin-tetrahydride, $C_{10}H_{12}$; cymen, $C_{10}H_{16}$; reduction of cymol.

Diphenyl.—G. Schultz.—This paper contains the preliminary account of some results of researches undertaken with the view of ascertaining more correctly the constitution of the aromatic hydrocarbons. The author treats on the preparation and oxidation of diphenyl, on monobrom-diphenyl, oxidation of dibrom-diphenyl, and on reduction of diphenyl.

Some of the Derivatives of Benzyl-Toluol.—Th. Zincke.—This essay treats on—(1) the action of bromine upon benzyl-toluol, $C_6H_5-\!-\!-CH_2-\!-\!-C_6H_4-\!-\!-CH_3$; (2) action of nitric acid, di-nitro-benzyl-toluol, $C_{14}H_{12}(NO_2)_2$; (3) nitro-methyl-benzophenon, $C_6H_4(NO_2)-\!-\!-CO-\!-\!-C_6H_4-\!-\!-CH_3$, or—

$$C_6H_5-\!-\!-CO-\!-\!-C_6H_3(NO_2)-\!-\!-CH_3;$$

(4) tetra-nitrobenzyl-toluol, $C_{14}H_8(NO_2)_4$; (5) action of fuming sulphuric acid, benzyl-toluol-disulpho acid, $C_{14}H_{12}(SO_2H)_2$, and the salts of that acid.

Benzyl-Ethyl-Benzol.—J. T. Walker.—This body—

$$C_6H_5-\!-\!-CH_2-\!-\!-C_6H_4-\!-\!-C_2H_5,$$

the mode of preparation of which is described at length, is a colourless liquid, exhibiting a faintly aromatic odour; sp. gr. at 18·9°, 0·985; readily soluble in alcohol, ether, and chloroform; boils at from 294° to 295°. By oxidation, this hydrocarbon (consisting, in 100 parts, of—C, 91·84; H, 8·16) yields benzoyl-benzoic acid.

Benzyl-Sulpho Acid.—G. Barbaglia.—This memoir treats on the preparation of benzyl-sulpho acid by means of the oxidation of the sulphur compounds of benzyl.

Some of the Derivatives of Benzylamine.—J. Strakosch.—This essay is divided into the following sections:—Introduction, treating on monamines in general, and on the best modes of preparation of benzylamine; cyanbenzylamine; action of chlorcyan upon benzylamine; cyanbenzylamide; tribenzyl-melamine; dibenzyl-guanidin; dibenzyl-sulpho-urea; benzyl-acetamide; nitrobenzyl-mercaptan; nitrobenzyl-sulphide.

Observations on Isobutyl-Aldehyde.—A. Pfeiffer.—In the first part of this essay the preparation of the isobutyl-aldehyde is described at length. In pure state, this substance is a colourless, strongly refrangible liquid, which yields with ammonia a rather difficultly crystallising compound. Isobutyraldin is, in crude state, an amorphous solid mass, which, however, may be obtained in crystalline state by repeated treatment with ether. Carbo-isobutyraldin, $C_9H_{18}N_2S_2$, obtained by treating isobutyl-aldehyde with sulphide of carbon, is a solid body fusing at 91°.

Phenyl-Diacetic Acid.—R. Biedermann.—After first referring to the researches of Grimaux on this subject, the author records at great length the rather circuitous mode of preparation of this substance, the formula of which is—

$$C_6H_4\begin{cases}CH_2,CO,OH\\CH_2,CO,OH\end{cases}$$

It is an amorphous, solid substance, fusing at 236°, but becoming decomposed at the same time.

Synthesis of Aromatic Monamines by Conversion of Atoms (Atomwanderung) into Molecules.—Dr. A. W. Hofmann.—This lengthy monograph is divided into the following sections:—Investigation of the amines formed at a moderately-elevated temperature; investigation of the amines formed at a high temperature.

Conversion of Aniline into Toluidine.—Dr. A. W. Hofmann.—The preliminary account of some researches concerning which a more extensive paper will be published.

Action of Ammonia upon Nitranissic Acid and Griess's Phenyl-Diamine.—H. Salkowski.—Notwithstanding the intrinsic value of this essay, elucidated by complex formulæ, its contents are not well suited for useful abstraction.

Bulletin de l'Academie Royale des Sciences, des Lettres et de Beaux Arts de Belgique, No 6, 1872.

This number contains no original papers relating to chemistry, but we call attention to the two following memoirs:—

Lightning-Conductor Lately Destroyed by Lightning at Wetteren (West Flanders).—Drs. Gloesener and Maas.—It appears that a lightning-conductor had been placed on a church recently built in this town, but it was not so contrived as practical experience has proved to be necessary to ensure a safe passage of the electric discharge, and, during a severe thunderstorm on May 23 last, the conductor was struck and broken in two places, the result being serious injury to the building. The authors examined the rods immediately after the accident, and illustrate, by means of an engraving, the damage done; they observe that, unless lightning-conductors are made with care, and tested by means of a weak galvanic current and galvanometers, they may, instead of acting as a protection, be a source of danger and serious injury to surrounding buildings.

Newly-Executed Exploration of the Bone Cavern at Engis, near Liège.—E. Du.—Illustrated with several engravings and map. This paper contains an account of the author's search for fossil bones and flint implements.

Les Mondes, August 15, 1872.

Death of M. Delaunay.—With regret we record the death of this eminent *savant*, who was drowned while bathing in the sea at Cherbourg on the 4th inst. As Director of the National Observatory at Paris, the deceased was at the head of French astronomers; he was, moreover, a scientific man of high standing, and his decease, at the early age of 56 years, will be severely felt in his native country, and be deeply regretted by all scientists who knew the value of his researches and labours.

White-Coloured Aurora Borealis.—A. Cheux.—The detailed account of the scientific observations of this phenomenon as seen at the observatory of Baumette, near Angers (France).

Observatory at Toulouse.—Rev. F. Moigno.—It appears that an astronomico-meteorological observatory, which is to be established in this ancient city, will be placed under the care of a visiting committee and director, presided over by the Mayor of Toulouse.

Electric Clockwork.—C. F. Mildé.—The exhaustive description, illustrated by several engravings, of machinery for indicating true mean time by the aid of one good clock.

Various Methods of Applying Osmose to Sugar Refining.—M. Dubrunfaut.—By osmose, the author understands a process by which the saline matter, which may impede the crystallisation of sugar, is eliminated, the operation being based upon the different degree of diffusibility of sugar and saline matter, viz., salts of potassa, soda, ammonia, and magnesia, but neither lime nor colouring matter. It appears that many beet-root sugar makers apply this method in all its technical details.

Iris Observed on the Lake of Genève.—Dr. E. Wartmann.—The account of a luminous effect of the solar rays lately observed by the author on the banks of this peculiar lake. It appears that this phenomenon is not uncommon on Lake Leman, it having been noticed in 1869.

Behaviour of Cadmium, Iron, and Tin in Nitric Acid.—Dr. Schönn.—The author states that the action of nitric acid on iron alters its nature; this is shown by its being incapable of reducing copper when immersed into a solution of that metal. Cadmium is not acted upon by nitric acid if a platinum wire is wound round the rod of metal when immersed in the acid, and the same obtains with tin. It would appear that the electric condition of the metals being altered is the cause of the effects observed.

Fulminatine.—Rev. F. Moigno.—Under this title a new explosive compound is in use, consisting of nitro-glycerine, silica, and 15 per cent of a peculiar substance, the composition of which is kept secret, but which is, on ignition, entirely converted into gaseous matter.

Pharmaceutische Zeitschrift für Russland, No. 1, 1872.

Ammonium Compound of Cantharidine.—Dr. E. Masing.—Cantharidine combines with ammonium, but this body is a rather unstable compound, and cannot be obtained in solid state except by evaporation of the solution of cantharidine in ammonia *in vacuo*. The formula of this substance is—

$$\left.\begin{matrix} NH_4 \\ C_{10}H_6''O_2 \\ C_{10}H_6''O_2 \\ H \end{matrix}\right\} O_6$$

In 100 parts—84·85 of cantharidine, and 7·79 of ammonium. The author mentions that other compounds of these bodies exist, and also speaks of an amido combination of cantharidine which is soluble in chloroform.

No. 2, 1872.

In addition to papers more particularly belonging to pharmaceutical science, this number contains the following memoir relating to chemistry:—

Quantitative Estimation of the Alkaloids Contained in Ipecacuanha, Aconite, Nicotiana, and Conium.—Dr. O. Zenoffsky.—The first instalment of an exhaustive monograph on this subject; the author reviews, in this portion, the various methods proposed for estimating the quantity of emetine present in the drug, and gives a comparative review of the results obtained by the application of the various methods. He lastly describes a plan of titration whereby, from a given quantity of ipecacuanha treated with proper solvents, the emetine may be rapidly determined; the quantity of this alkaloid present in the root varies, according to the quality of the root, from 2·425 to 3·89 per cent.

No. 3, 1872.

This number contains the concluding portion of the above essay. The author points out the best and most reliable methods for quantitatively estimating aconitine, nicotine, and coniine.

La Revue Scientifique de la France et de l'Etranger, August 17, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following essay:—

Analysis of Soil by Plants.—Dr. G. Ville.—The continuation of the author's course of lectures on practical agriculture in the experimental field at Vincennes.

Polytechnisches Journal von Dr. E. M. Dingler, second number for July, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Bunsen's New Chromic Acid Galvanic Battery.—J. Müller.—This algebraico-physical essay contains the account of a series of experiments for testing the efficacy of a Bunsen battery in which, instead of nitric acid, a mixture of bichromate of potassa and sulphuric acid is employed.

Bessemer and Cast Steel.—Dr. Dingler.—This paper treats on the relative quality of the two kinds of steel, and on the comparative value of both for technical use.

Pyrometrical Assay of the so-called Dinas Fire-Bricks and Dinas Sandstone.—Dr. C. Bischof.—This memoir records the results of a series of pyrometrical experiments made for the purpose of testing the fire-resisting quality (degree of infusibility) of these materials, which are made at Neath, South Wales. It appears that the bricks, as well as the cement and sandstone, are in a very high degree refractory, on account of containing hardly anything else than silica.

Adulteration of Ultramarine.—C. Fürstenau.—This paper contains an account of a method of mixing with genuine ultramarine white-coloured substances, such as fibrous gypsum, alabaster, and sulphate of potassa, so as to produce a deep blue, but largely weighted, ultramarine, which, however, is of course much less suitable for use.

Testing Bees'-Wax for Adulterations.—E. Donath.—The author reviews, in this paper, the labours of Landolt, Breitenlohner, Dullo, Wagner, Fehling, and others on the subject of the many adulterations of white, as well as yellow, bees'-wax. Paraffin, white resin, tallow, stearic acid, and Japanese wax are the chief adulterants. The author recommends the estimation of the sp. gr. of the substance to be investigated, and describes an apparatus, illustrated by a woodcut, for this purpose.

Contribution to the Technology of the Tanning Materials.—Dr. R. Wagner.—This monograph treats on the leather-making substances, viz., sumac, oak-bark, valonia, and bablah. The author observes that tannin (tannic acid) is not a material which is capable of producing leather with corium, and that the relative value of the tanning materials depends, not only upon the quantity of tannin they contain, but also upon accessory substances as yet only very imperfectly known.

Studies for Establishing a Scientifically-Arranged Tanning Method.—A. Reimer.—The first instalment of this lengthy monograph, divided into the following sections:—Introduction, containing a *resumé* of the labours of Dr. Knapp and others on this subject; skin; the material which causes the agglutination of the fibres; pure fibre.

Removal of Ink-Stains from Coloured Woven Tissues.—Dr. Böttger.—The author recommends the use of pyrophosphate of soda for this purpose, the salt to be applied in concentrated solution. The recent ink-stains are readily removed, but older stains require washing and rubbing with the solution for a long time.

Annalen der Physik und Chemie, von Dr. J. C. Poggendorff, No. 7, 1872.

This number contains the following original papers and memoirs relating to physico-chemical sciences:—

Passage of Caloric Rays through Diathermane Plates when Placed in an Inclined Position.—H. Knoblauch.—An algebraico-physical monograph, illustrated by a series of tables containing results of experiments.

Experimental Researches on Fluorescence.—E. Hagenbach.—The continuation of an exhaustive memoir on this subject.

Influence of the Astronomical Motion on Optical Phenomena (viz., of the Light emitted by the Sun, Stars, &c.).—The continuation of a valuable essay on this subject.

Evolution of Heat by Friction between Fluids and Solids.—O. Maschke.—The description, chiefly in the shape of tables, of a series of results of experiments made with amorphous siliceous substances converted into small granules, and water in a peculiarly-arranged apparatus, so contrived that the amount of heat evolved by the absorption of the water by these substances could be accurately ascertained.

Magnetising Function of Soft Iron, and more particularly under the Influence of Feeble Dispersing Power.—Dr. A. Stoletow.

Meteorite which fell June 17, 1870, at Ibbenbühren (Prussia).—G. vom Rath.—This essay, illustrated by engravings exhibiting views of the meteorite, treats at length on the phenomena observed by the falling of the stone, which mineralogically is composed of enstatite or bronzite—

$$\left.\begin{matrix} Mg \\ Fe \end{matrix}\right\} SiO_3.$$

Hail-Stones of Unusual Size and Shape.—A. Moritz.—The account of a severe hail-storm observed at Bjeloi-Kliutsch near Tiflis (Russia), at 41° 10′ N. lat. and 62° 19′ E. long., illustrated with engravings representing the size and shape of the hail-stones.

Microscopical Structure of Hail-Stones.—J. H. L. Flogel.—A memoir illustrated with engravings.

Apparatus for Exhibiting the Phenomenon of the Freezing of Water.—Dr. G. Krebs.—Illustrated by woodcuts.

Journal für Gasbeleuchtung und Wasserversorgung, Nos. 9, 10, and 11, 1872.

These numbers only contain papers relating to gas- and water-works' engineering.

NOTES AND QUERIES.

Test for Anthracen.—(Reply to D. G.)—Peruse Vols. 24, 25, and 26 of Chemical News, and also Dr. Kopp's memoir in *Moniteur Scientifique Quesneville.*

Lamp for Water-Oven.—(Reply to "Albion.")—Try a paraffin oil lamp with Argand burner, and get a copper chimney to it. Such a lamp gives a great heat, and can be regulated to suit any temperature.

Pure Aluminium.—(Reply to E. Purdon.)—You can only prepare this metal by decomposing solid chloride of aluminium with sodium. For the full method of manipulation consult Dr. W. A. Miller's work on Chemistry.—*Z.*

Dryer for Tarry Substances.—I shall feel obliged if any of your readers can inform me what dryer to use (a cheap one) to make tarry substance dry quicker. I do not mind if the lasting property of the tar is deteriorated a little.—C. E.

Manufacture of Iodine.—Can any of your readers inform me if there is any change or improvements in the manufacture of iodine other than the old method of preparing it from the mother-liquor of kelp; if so, will they kindly give a description of such improvements.—Medicus.

Hydrocyanate of Morphia.—(Reply to J. H. L. Schumann)—Dr. Duflos does not mention the salt you speak of, and considering the volatility and instability of hydrocyanic acid, it is not likely that a solid compound of that acid and morphia exists. There exists a cyanide of bismuth, obtainable by precipitating a solution of neutral nitrate of bismuth with cyanide of potassium, but that compound should not be used in medicine. Dissolve some *pure* carbolic acid in water, or better still, in dilute acetic acid, and steep the meat in it for some hours. The time of immersion must depend upon the size and weight of the meat; it is then dried and cured as smoke-dried meat. —A. A.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2276. W. B. G. Bennett, Nichols Square, Hackney Road, Middlesex, and J. C. Watt, Lancaster Road, Notting Hill, Middlesex, "Improvements in the preparation of asphalte, and in the application thereof to the construction of roads and footpaths, and other purposes."

2286. A. Browne, Gracechurch Street, London, "Improvements and modifications in the treatment of phosphate in general, and in the production and purification of phosphoric acid and its combinations."—A communication from H. Storck, E. Hentsch, A. Hentsch, A. Lutscher, and F. Grininger, Paris.—Petitions recorded July 30, 1872.

2318. J. Henderson, New York, U.S.A., "Improvements in converting cast-iron into steel and wrought-iron, and purifying cast-iron for foundry and other purposes."—Petition recorded August 3, 1872.

2331. C. M. T. du Motay, Boulevard de Strasbourg, Paris, "An improved mechanical and chemical method of epurating the cast-irons, in order to allow the same to be directly or indirectly transformed into iron or steel."—Petition recorded August 5, 1872.

2341. C. Morfit, Baltimore, Maryland, U.S.A., "Improvements in the manufacture of pure phosphates of lime."—Petition recorded August 6, 1872.

2351. G. M. Moore, Liverpool, "Improvements in the process of evaporating or concentrating alkaline liquors in the manufacture of caustic soda, caustic potash, soda ash, and other similar substances; also for heating or boiling and refrigerating solutions in breweries, distilleries, chemical and other manufactories, and in the apparatus employed therefor."—Petition recorded August 7, 1872.

INVENTIONS PROTECTED BY THE DEPOSIT OF COMPLETE SPECIFICATIONS.

2369. W. R. Lake, Southampton Buildings, London, "Improved nutritious compounds."—A communication from J. R. Weed, New York, U.S.A.—Recorded August 9, 1872.

2389. H. A. Bonneville, Rue de la Chaussée d'Antin, Paris, "A new or improved process of manufacturing cast-steel."—A communication from H. A. Levallois, Rue de Chabrol, Paris.—Recorded August 10, 1872.

NOTICES TO PROCEED.

954. V. Caratti, Brixton, Surrey, and S. K. Church, Fenchurch Street, London, "Improvements in heating, and in generating hydrogen for that purpose."—Petition recorded March 30, 1872.

989. J. C. Sellars, Birkenhead, Cheshire, "Improvements in obtaining hydrocarbon liquid gas for illuminating and heating purposes, and coke."—Petition recorded April 4, 1872.

1065. L. A. Badin, New Ormond Street, Middlesex, "A new or improved method of deodorising human excrementitious matters, and of its manufacture into farm manure, suitable for all descriptions of agricultural purposes, and to all localities."—Petition recorded April 11, 1872.

1089. J. Anderson, Newbuildings, Londonderry, Ireland, "Improvements in refining iron, in obtaining malleable iron and steel, and in apparatus therefor."—Petition recorded April 12, 1872.

1456. W. Clark, Chancery Lane, Middlesex, "An improved method of extracting anthracene contained in coal-tar and the pitch accruing therefrom, without either carbonising or decomposing the pitch."—A communication from P. Audouin, Paris.—Petition recorded May 13, 1872.

1586. W. R. Lake, Southampton Buildings, London, "Improved processes and apparatus for the extraction of oil and the production of flour from maize."—A communication from H. C. Cavayé, Paris.—Petition recorded May 24, 1872.

1608. J. H. Selwyn, Gloucester Crescent, Hyde Park, Middlesex, "A new method of treating refractory ores of silver."—Petition recorded May 27, 1872.

2261. W. E. Gill, Salisbury Street, Strand, W.C., "Improvements in treating vegetable juices, and in the apparatus and materials to be employed therefor."—Petition recorded July 29, 1872.

PATENTS SEALED.

476. T. Rowan, Glasgow, N.B., "Improvements in preparing carbonates or oxides of lead and zinc for use as pigments and otherwise." —Dated February 15, 1872.

508. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the production of chlorine and hydrochloric acid, and in apparatus employed therein."

509. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the manufacture of alkalies, and in apparatus employed therein."

513. J. Anderson, Newbuildings, Londonderry, Ireland, "Improvements in reducing oxides, and in obtaining iron, sodium, potassium, phosphorus, chlorine, or their compounds, and in apparatus therefor."—Dated February 17, 1872.

547. S. W. Rich, Chenies Street, Middlesex, "An improved process for treating aluminous schist or shale."—Dated February 20, 1872.

572. B. Hunt, Serle Street, Lincoln's Inn, Middlesex, "Improvements in the manufacture of leather, and in the processes and compositions to be employed therein."—A communication from J. C. White, Quincy, Illinois, U.S.A.—Dated February 22, 1872.

1162. H. Warry, Parkstone, Dorset, "Improvements in various beverages."—Dated April 18, 1872.

1752. C. F. Hengst, Fulham, Middlesex, and J. B. Muschamp, Kensington, Middlesex, "Improvements in the manufacture of gas, and in the apparatus employed therein."—Dated June 11, 1872.

1795. J. Imray, Southampton Buildings, Middlesex, "Improvements in the manufacture of iron and steel, and apparatus therefor." —A communication from T. S. Blair, Pittsburg, Penn., U.S.A.—Dated June 14. 1872.

1880. W. Morgan Brown, Southampton Buildings, London, "An improved apparatus for extracting ammonia, in the form of liquid ammonia, from crude ammoniacal liquors."—A communication from J. H. Elwert, Geneva, and J. J. M. Pack, Basel, Switzerland.

1881. E. Milner, Warrington, Lancashire, "Improvements in the method of producing white pigments from lead."

1886. J. Thomas, Middlesbrough, Yorkshire, "Improvements in furnaces for generating gas and melting metals."—Dated June 22, 1872.

TO CORRESPONDENTS.

*** Vol. XXV. of the Chemical News, containing a copious index, is now ready, price 11s. 4d., by post, 12s., hansomely bound in cloth, gold lettered. The cases for binding may be obtained at our office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our office, or, if accompanied by a cloth case, for 3s. Subscribers wishing to complete their sets of volumes are requested to apply to the publisher, who will give them information respecting scarce numbers and volumes. Vol. xxvi. commenced on July 5th, and will be complete in twenty-six numbers. Reading Cases, price 1s. 6d. each, post free, may also be obtained at the Office.

B. Read.—Our Students No. will not be published before Sept. 13th. It will, of course, contain the information you require.

Prof. Henry Morton, Hugo Tamm, R. W. Higgs, A. B. MacDowall, W. L. Carpenter, J. W. Mallet, are thanked for their communications.

BOOKS RECEIVED.

Chemistry, Inorganic and Organic, with Experiments. By Charles Loudon Bloxam. Second Edition. J. and A. Churchill.

Cooley's Cyclopœdia of Practical Receipts. Fifth Edition. Revised and partly Re-written by Richard V. Tuson, F.C.S. J. and A. Churchill.

Qualitative Chemical Analysis. By Dr. C. Remigius Fresenius. Eighth Edition. Translated by A. Vacher. J. and A. Churchill.

Sewer Gas, and How to Keep it out of Houses. By Osborne Reynolds, M.A. Macmillan and Co.

Monthly Review of Dental Surgery, Vol. I.

The Hygiene of Air and Water. By W. Procter, M.D., F.C.S. R. Hardwicke.

Canada Medical and Surgical Journal.

NOTICE TO AMERICAN SUBSCRIBERS.

In answer to numerous inquiries, the Publisher begs to state that Subscribers in the United States can be supplied with the CHEMICAL NEWS from this Office, post free, for the sum of Six dollars or £1 2s. 4d. per annum payable in advance.

THE CHEMICAL NEWS.

Vol. XXVI. No. 668.

(STUDENTS' NUMBER.)

SCHOOLS OF CHEMISTRY.

EXAMINING BOARDS.

UNIVERSITY OF LONDON.

Candidates for any Degree granted by this University are required to have passed the Matriculation Examination, to which no candidate is admitted unless he has produced a certificate showing that he has completed his sixteenth year.

The Fee for this Examination is £2.

The Examination will be held on Monday, January 13th, 1873, and includes the following subjects:—

Natural Philosophy.*

Mechanics—

Composition and Resolution of Statical Forces.

Simple Machines (*Mechanical Powers*): Ratio of the Power to the weight in each.

Centre of Gravity.

General laws of Motion, with the chief Experiments by which they may be illustrated.

Law of the Motion of Falling Bodies.

Hydrostatics, Hydraulics, and Pneumatics—

Pressure of Liquids and Gases, its equal diffusion, and variation with the depth.

Specific Gravity, and modes of determining it.

The Barometer, the Syphon, the Common Pump and Forcing-Pump, and the Air-Pump.

Acoustics—

Nature of Sound.

Mode and Rate of Propagation of Sound.

Musical Tones.

Optics—

Laws of Reflection and Refraction.

Formation of Images by Simple Lenses.

Chemistry.

Heat—its sources. Expansion. Thermometers—relations between different Scales in common use. Difference between Temperature and Quantity of Heat. Specific and Latent Heat. Calorimeters. Liquefaction. Ebullition. Evaporation. Conduction. Convection. Radiation.

Chemistry of the Non-Metallic Elements; including their compounds as enumerated below—their chief physical and chemical characters—their preparation—and their characteristic tests.

Oxygen, Hydrogen, Carbon, Nitrogen. Chlorine, Bromine, Iodine, Fluorine. Sulphur, Phosphorus, Silicon.

Combining Proportions by weight and by volume. General Nature of Acids, Bases, and Salts. Symbols and Nomenclature.

The Atmosphere—its constitution; effects of Animal and Vegetable Life upon its composition.

Combustion. Structure and Properties of Flame, Nature and Composition of ordinary Fuel.

Water. Chemical peculiarities of Natural Waters, such as rain-water, river-water, spring-water, sea-water.

Carbonic Acid. Carbonic Oxide, Oxides and Acids of Nitrogen. Ammonia. Olefiant Gas, Marsh Gas, Sulphurous and Sulphuric Acids, Sulphuretted Hydrogen. Hydrochloric Acid. Phosphoric Acid and Phosphoretted Hydrogen. Silica.

* The Questions in Natural Philosophy will be of a strictly elementary character.

Bachelor of Science (B.Sc.)

This degree is conferred on candidates who pass a satisfactory examination in Mathematics, Mechanical and Natural Philosophy, Botany, and Vegetable Physiology, Zoology, and Chemistry.

First B.Sc. Examination.

No candidate (with the exception of such as have obtained Honours at the Matriculation Examination in the preceding January) is admitted to this examination within one academical year of the time of his passing the Matriculation Examination.

The Fee for this Examination is £5.

The examination will commence on the third Monday in July. It is conducted by means of printed papers; but the Examiners are not precluded from putting, for the purpose of ascertaining the competence of the candidates to pass, *viva voce* questions to any Candidate in the subjects in which they are appointed to examine.

The First Examination includes the following subjects:—

Natural Philosophy.

Heat—

Sources of Heat; conduction—convection.

Effects of Heat; expansion generally—of water—of gases and vapours; liquefaction; vaporisation; latent heat; expansive form of steam; dew-point; gases and vapours compared.

Specific Heat.

Thermometers; Pyrometers.

Heat in the Radiant state.

Electricity—

Sources of Electricity.

Static Electricity; dual character—insulation—induction—specific inductive capacity—equivalent antithetic states—disruptive discharge—convection; Electroscopes—Leyden Jar, &c.

Dynamic Electricity; Conduction—the electric current—derived currents—induction of currents; Voltaic Pile and other voltaic arrangements.

Thermo-Electricity; Electro-Thermometer.

Magnetism—

Magnets, the Earth, &c.; Induction—communication—retention—Magnetic relations of iron, steel, &c.

Electro-Magnetism—as in the spark—in conducting media—in soft iron; Magneto-Electricity; principle of Electro-magnetic and Magneto-Electric machines.

Terrestrial Magnetism.

Inorganic Chemistry.

Matter; simple and compound.

Elementary bodies classed. Metallic and Non-Metallic bodies.

Chemical combination and Mechanical Mixture. Solution.

Outlines of Crystallography. Isomorphism. Dimorphism. Allotropic conditions of matter. Chemical Affinity, Laws of Combination by weight and by volume, as deduced from the history of the individual elements. Equivalent Numbers. Equivalent Volumes. Symbolical Notation, including questions on the Unitary System. Formulæ. Nomenclature.

Chemical actions produced under the influence of Heat. Nature of Combustion. Structures and Properties of Flame. Principles of Illumination. Chemical action of Light. Photography.

Oxygen. Ozone.

Hydrogen. Water.

Nitrogen. Chemical constitution of the Atmosphere. Diffusion of Gases. The Oxides of Nitrogen; Nitric Acid. Ammonia.

Chlorine, Bromine, and Iodine. Their compounds with Oxygen and Hydrogen. Theory of Bleaching.

Fluorine and Hydrofluoric Acid.

Sulphur, Sulphurous Acid. Manufacture and Chemical applications of Sulphuric Acid. Other Oxygen compounds of Sulphur. Sulphuretted Hydrogen.

Phosphorus. Oxygen and Hydrogen compounds of Phosphorus. Theory of Acids. Monobasic, Dibasic, and Tribasic Acids.

Carbon. Carbonic Oxide and Carbonic Acid. The principal Hydrogen compounds of Carbon. Manufacture of Coal Gas.

Silicon and Boron. Their compounds with the elements previously enumerated.

Metals. Characters of Metals as a class. Metallurgical Processes. Alloys. Classification of the Metals.

Potassium. Nitre. Gunpowder. Theory of the action of Gunpowder.

Sodium. Manufacture of Carbonate of Soda.

Barium. Strontium. Calcium. Mortars. Cements.

Magnesium. Aluminum. Glass. Porcelain.

Manganese. Iron. Composition and properties of Cast-Iron, Wrought-iron, and Steel. Chromium.

Cobalt. Nickel. Zinc. Cadium.

Lead. Manufacture of White-Lead.

Copper. Mercury. Bismuth. Tin. Arsenic. Antimony.

Silver. Gold. Platinum.

Principal compounds of the Metals with the Non-Metallic Elements. Theory of Salts.

Principles of Mineral Analysis.

Principles of Electro-Chemistry.

For the First Examinations, a knowledge of Inorganic Chemistry only is necessary.

Examination for Honours.

Candidates for Honours in Chemistry are examined in any of the following subjects, at the option of the Examiners:—

Elementary Substances and their combinations.

Electro-Chemistry.

Radiant Chemical Action.

In the Examination for Honours, the Candidate, being not more than twenty-two years of age, who most distinguishes himself in Chemistry and Natural Philosophy, will receive an Exhibition of Forty pounds per annum for the next two years.

Second B.Sc. Examination.

This Examination commences on the fourth Monday in October. Candidates for this Examination who have not previously taken the degree of B.A. are required either to have passed the First B.Sc. Examination at least one Academical year previously, or to have passed the First M.B. Examination in this University.

The Fee for this Examination is £5.

This Examination embraces Organic Chemistry, including the following subjects:—

Ultimate Analysis of Organic bodies. Calculation of Empirical Formulæ. Methods of controlling Empirical Formulæ. Determination of the Equivalents of organic acids and bases; examination of products of Decomposition; determination of the Vapour-density of volatile bodies.

Law of Substitution. Compound Radicals. Homologous Series.

The Chemical History of the Cyanogen group. Cyanogen. Hydrocyanic Acid. Cyanic Acid and Urea. Fulminates. Cyanuric Acid. Sulphocyanic Acid. Chlorides of Cyanogen. Uric Acid.

Amylaceous and Saccharine Substances. Fermentation. Alcohol, Wine, Beer, Bread, &c.

Homologues of Alcohol. Ethers, simple and mixed. Oxidation of Alcohol. Aldehyde and Acetic Acid, and their homologues. Anhydrides, simple and mixed. Compound Ethers.

Diatomic Alcohols and their Acids. Glycol and Oxalic Acid and their homologues.

Triatomic Alcohols. Glycerine. Fatty and Oily bodies. Saponification.

Vegetable Acids;—the principal.

Ammonia and its Derivatives. Ammonium and Ammoniacal Salts. Amides and Amines; their Classification. The chief Natural Organic Bases.

Colouring Matters. Indigo and its derivatives. Principles of Dyeing.

The chief constituents of the Vegetable organism. Cellulose, Vegetable Fibrin, Albumen, Casein, Glutin, &c.

The chief constituents of the Animal organism. Animal Fibrin, Albumen, Casein, Gelatin. Blood, Milk, Bile, Urine, &c.

Decay, Putrefaction. Destructive Distillation.

The Chemical Principles of the process of Nutrition and of Respiration in Plants and Animals.

Examination for Honours.

The Candidate, not more than twenty-three years of age, who, in the Examination for Honours, most distinguishes himself in Chemistry, will receive Fifty pounds per annum for the next two years, with the title of University Scholar.

Doctor of Science (D.Sc.).

This Examination is held within the first twenty-one days of June, and occupies four days.

No Candidate is admitted to the Examination for the Degree of D.Sc. until after the expiration of two Academical years from the time of his obtaining the Degree of B.Sc. in this University.

Candidates for the Degree of D.Sc. in any year, must give notice of their intention to the Registar, and pay to him a Fee of Ten pounds, on or before the 1st of April.

Chemical Candidates can be examined either in Inorganic or Organic Chemistry; but no Candidate will be approved by the Examiners unless he has shown a thorough practical knowledge* of the *Principal Subject*, and a general acquaintance with the *Subsidiary Subject*, or *Subjects*, specified as belonging to the Branch so selected.

Inorganic Chemistry.

Principal Subject—Inorganic Chemistry.

Subsidiary Subjects—Either Organic Chemistry; or, Mineralogy, Crystallography, and Chemical Technology in its relations to Inorganic Chemistry.

Organic Chemistry.

Principal Subject—Organic Chemistry.

Subsidiary Subjects—Either Inorganic Chemistry; or, Chemical Technology, in its relations to Organic Chemistry, and the Chemistry of Animal and Vegetable Life.

EXAMINATIONS IN CONNECTION WITH THE DEPARTMENT OF SCIENCE AND ART, SOUTH KENSINGTON.

A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom.

This sum is administered by the Science and Art Department.

The object of the grant is to promote instruction in Science, especially among the Industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

The following are among the Sciences towards instruction in which aid is given:—Acoustics, Light, Heat, Magnetism, and Electricity, Inorganic Chemistry, Organic Chemistry, Geology, Mineralogy, Mining, Metallurgy.

The assistance granted by the Science and Art Department is in the form of—1. Public Examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions. 2. Payments on results to teachers. 3. Scholarships and Exhibitions. 4. Building Grants. 5. Grants towards the purchase of apparatus, &c.

* It must be understood that the candidate for the Degree of D.Sc. is expected to be so fully conversant with the principal subject he may select, as to be able to go through any examinational test (whether theoretical or practical) of his acquirements in it that can be fairly applied.

CHEMICAL LECTURES AND LABORATORY INSTRUCTION.

UNIVERSITY COLLEGE.

FACULTY OF SCIENCE.

Dean.—Professor J. B. Sanderson, M.D., F.R.S.

Vice-Dean.—Professor A. W. Williamson, Ph.D., F.R.S.

The Session begins on Wednesday, the 2nd of October, and ends on Friday, the 20th of June.

It is divided into three Terms, as follows:—Michaelmas term, from October 2nd until December 14th; Lent term, from January 6th, 1873, till March 18th; Summer term, for Lectures, from March 19th till June 11th, all inclusive.

Chemistry.—Professor Williamson, Ph.D., F.R.S.

A. General Course.

Lectures daily, except Saturday, from 11 to 12 a.m., up to the last week in March.

Exercises on Tuesdays, Wednesdays, Thursdays, and Fridays, from 9 to 10 a.m.

Fee for the Whole Course of Lectures, £7 7s.; for the First or Second Half Course, separately, £4 4s.; for the Second Half when the First has been taken, £3 3s.; Perpetual, £9 9s.; for the Organic Course alone, £2 2s.

Fee for the Exercise-Class—For the Course, £2 2s.; for the Half Course, £1 1s.

The Instruction in this Class is of two kinds, consisting partly of Experimental Lectures by the Professor, partly of Exercises and personal instruction on the subject of the Lectures by Tutors, under the direction of the Professor.

Students cannot profit duly by attendance on the Lectures, unless they work at the subject of each Lecture so as to make it their own.

Attendance on the tutorial part of the Class enables Students to do their work more effectually and rapidly than they can do it by themselves.

The First Half of the Course to Christmas includes those parts of Chemistry which are required for the Matriculation Examination of the University of London.

The Second Half of the Course, from January to March, includes the following subjects:—

I. Preparation and properties of the chief metals, including their characteristic reactions and most important salts. Detection of Metallic Poisons. Quantitative Estimation of Metals. Principles of Classification. Monatomic, Diatomic Metals, &c.

A weekly *viva voce* examination is held during the First Half Course and the commencement of the second Half Course.

Organic Chemistry.

This commences in the second week in February, and occupies Five Lectures weekly till about the end of March. It includes a study of the characteristics and metamorphoses of the chief organic acids, bases, alcohols, ethers, colouring matters, &c. Methods of ultimate and proximate analysis. Determination of molecular weights. Theory of types; of compound radicals. Phenomena of fermentation, &c.

Teachers of Chemistry are trained in the theory and practice of their profession. A two years' Course is absolutely requisite for this purpose; but Students will with advantage devote a longer period to it.

The first year is occupied with attendance on the Courses of Chemistry and of Analytical Chemistry. In the second year the Student again attends the Course of Chemistry, and is entrusted with teaching work in conjunction with the Tutors of the Class. At the same time he continues to work in the Laboratory at analysis and original research.

In order to qualify themselves for rising to the higher ranks of the Profession, gentlemen remain for a further period, in which case they may obtain remunerative work in teaching through the recommendation of the Professor.

It must not, however, be supposed that a study of Chemistry alone, however complete, is sufficient to qualify a man to teach the Science effectively. A competent knowledge of Physics, Mathematics, and either French or German must necessarily be acquired at some period of his Student's Course.

B. Analytical and Practical Chemistry.

I. Birkbeck Laboratory.

The instruction in the Laboratory is intended for beginners as well as for more advanced students. It includes practice in the construction and use of apparatus for preparing the common gases, acids, bases, salts, &c.; study of the qualitative methods of detecting and separating mineral or organic bodies from one another; also quantitative analysis in the wet way, organic analysis, vapour-densities, &c.; instruction in gas analysis.

More advanced Students are instructed in the methods of original research, especially in organic chemistry.

When accompanied or preceded by attendance on the Lectures on Chemistry, the Laboratory Course qualifies Students in the application of Chemistry to the Manufacturing Arts, Metallurgy, Medicine, or Agriculture, &c. Instruction is given in the principles and processes of Gas Analysis.

The Laboratory and Offices are fitted up completely with the most improved apparatus and utensils for experimental research, both for beginners and for advanced Students. They are open daily, from 9 a.m. to 4 p.m., from the 4th of October until the end of July, with a short recess at Christmas and at Easter. Saturday, from 9 to 2.

Fees for the Session, 25 guineas; six months, 18 guineas; three months, 10 guineas; one month, 4 guineas; exclusive of the expense of materials. A deduction of about 40 per cent is made for students who can attend only three fixed days per week.

A Gold Medal and Certificates of Honour are competed for by Students entered for the Session.

II. Summer Courses.

I. Elementary Course.

About Forty Lessons, of one hour each, on Tuesday, Wednesday, Thursday, and Friday, from 11 to 12, commencing in the first week of May. Students are taught the construction and use of apparatus for the preparation of the most important gases, acids, &c. The characteristic tests for the presence of the common acids and bases, including the chief metallic and other poisons. Also the processes for separating these bodies from one another.

Solutions are frequently given in the class for investigation.

The first six weeks of the Course are occupied by the study of the chief non-metallic elements, and their simple compounds. Metallic salts, &c., are subsequently studied.

Fee, including the cost of materials and apparatus, for the Course, £4 4s.; Perpetual, £7 7s.

II. Senior Course.

This Course consists of Twenty Lessons, of two hours each, on Mondays and Saturdays, from 10 to 12, commencing in the first week in May.

The First Half of the Course includes tests for fixed and volatile organic acids, nitrogenised acids, sugars, glycerine, alkaloids, &c.

The Second Half of the Course includes tests for mineral poisons in organic mixtures; also tests for organic bodies, such as the alkaloids, when mixed with other organic substances.

Volumetric methods of the quantitative analysis of sugar and urea, chlorides, phosphates, hardness of water, alkalimetry, are practised.

Analysis of milk and of ashes of blood.

Fee, including cost of materials and apparatus, for the Course, £4 4s.; Perpetual, £7 7s.

C. Summer Matriculation Course.

Professor Williamson, F.R.S., assisted by Charles Graham, D.Sc.

This Course includes those parts of Chemistry whi

are required for the Matriculation Examination of the University of London.

The Course consists of about Twenty Lessons in Practical Chemistry, and of an equal number of Oral Lessons. The Practical Lessons include the preparation of the common gases and acids, &c., and the study of their characteristic properties in relation to the elementary laws of combination.

The other Lessons are chiefly devoted to those parts of the subject which require fuller oral explanation than is given in the Practical Lessons. They include numerous exercises and questions, to which answers in writing are given by the Students. These Lessons will begin on Tuesday, April 8th, 1873, at 11 a.m.

The Class will meet on Tuesdays, Wednesdays, Thursdays, and Fridays, from 11 to 12; and some other meetings will be announced when the Class has assembled.

Fee, including cost of materials and apparatus, £4 4s.

ROYAL SCHOOL OF MINES AND COLLEGE OF CHEMISTRY.

The Lords of the Committee of Council on Education having decided to transfer the instruction in Physics, Chemistry, and Natural History from the Royal School of Mines, in Jermyn Street, and the College of Chemistry, in Oxford Street, to the New Buildings, in Exhibition Road, South Kensington, the Courses of Lectures and Practical Laboratory Instruction will in future be given at South Kensington.

Professor of Chemistry.—Dr. E. Frankland, F.R.S.

The instruction in Chemical Science embraces:—

(1). A Course of Lectures on Experimental Chemistry, with special reference to the applications of Chemistry in the Arts and Manufactures.

(2). A systematic Laboratory Course for the Practice of Chemical Analysis.

(3). An advanced Laboratory Course for technical applications of Chemical Analysis and for Chemical Research.

Chemical Lectures.—The Course consists of Forty Lectures on Mineral Chemistry and Thirty Lectures on Organic Chemistry.

Chemical Laboratories.—The Laboratories for instruction in chemical manipulation, in qualitative and quantitative analysis, the technical application of analysis, and in the method of performing chemical researches, are under the direction of Dr. Frankland, and will be opened on Monday, the 1st of October, 1872. The Laboratories at South Kensington Museum are now used for the instruction of the pupils of the Royal School of Mines.

There are three terms in the collegiate year, of three months each, commencing in the first week of October, January, and April, respectively. The Laboratory hours are from 10 a.m. to 5 p.m., with the exception of Saturdays, when the Laboratory closes at 2 o'clock.

Each Laboratory Student works independently, there being no classes. All operations are superintended by the Professor and his assistants. A table with drawers, cupboards, and shelves is appropriated to every pupil. The Institution supplies gas, fuel, and reagents. The larger and more expensive instruments of the Laboratory, such as air-pumps, thermometers, barometers, condensers, &c., may be used by the students, who are responsible for their safety. The students have to provide themselves only with the apparatus specified in the Laboratory regulations. More advanced students engaged in private researches have to supply themselves with such materials as are not included amongst the ordinary reagents of the Laboratory.

The charge for instruction in the Chemical Laboratory is £12 for three months, £9 for two months, and £5 for one month. This charge does not include the fees for attending the Lectures.

Professor of Metallurgy.—Dr. Percy, F.R.S.

The course of instruction in Metallurgy consists of Lectures and Laboratory Practice, especially in Assaying.

The object of the Lectures is the communication of such instruction as the student may be able to apply to the greatest practical advantage when he may be subsequently engaged in conducting any metallurgical process.

Metallurgical Laboratory.—This Laboratory is conducted by Mr. R. Smith, under the direction of Dr. Percy, and is devoted to practical instruction in Metallurgy, especially in Assaying. The nature of this instruction will be adapted to the special requirements of the student. It comprises:—Assaying in all its branches, especially of the more important metals, such as iron, copper, lead, tin, alloys of silver and gold, &c.; and the examination of ores and metallurgical products.

The ability of the student to make trustworthy assays is in every case thoroughly tested; and no certificate of competency is given to a student who has not furnished satisfactory proof that he is able to obtain accurate results.

There are three terms in the collegiate year, of three months each. The Laboratory hours are from 10 to 4 during November, December, January, and February; and from 10 to 5 during the other months, with the exception of Saturdays, when the Laboratory is closed.

The charge for instruction in the Metallurgical Laboratory is £15 for three months, £12 for two months, and £7 for one month.

Lectures to Working Men.—Short Courses of Lectures at suitable periods of the year are given in the evening to Working Men. These courses are systematic, and arranged so as to illustrate, within a period of two years, the principal subjects taught at the Institution. Those for the ensuing Session include Natural History, Geology, and Mineralogy.

KING'S COLLEGE.

Professor of Chemistry and Practical Chemistry—C. L. Bloxam, F.C.S.

Demonstrator.—W. N. Hartley, F.C.S.

Assistant ditto.—J. M. Thompson, F.C.S.

The Session commences on the 1st of October. Students of the first and second years are admitted to the Course of Theoretical and Applied Chemistry. The Course commences with a view of the forces which concur to the production of Chemical Phenomena, after which the laws of Chemical Attraction are discussed, and the Non-Metallic Elements and their principal compounds are described.

The metals and their principal compounds are next examined, care being taken to point out the applications of the Science to the Arts, and the processes of the different Manufactures of Metallurgy, and of Domestic Economy, are explained and illustrated.

Examinations of the Class, both *viva voce* and by written papers, are held at intervals during the Course, at the usual Lecture hour.

Third Year.—Students who have completed six Terms in this Department are admitted to a course of Practical Chemistry, consisting of Twelve Demonstrations in each term; and they go through a course of Manipulation in the most important operations of Chemistry, including the first steps of Analysis.

Any Student of this Department may be admitted to this Class at any period of his study, on payment of an extra fee.

Analytical and Experimental Chemistry.—Besides the Course of Chemical Lectures and the Summer Class of Practical Chemistry, provision is made for those Students who wish to become more minutely acquainted with the practical details of the Science. By means of this Class each Student is enabled to familiarise himself with the methods of analysis and research. After passing through a preliminary course of analytical operations, each Student devotes himself to such portions of the science as are most interesting to himself, or most likely to be practically useful to him. The Daniel Scholarship of £20, tenable for two years, is given every alternate year for original research in the Laboratory.

The Fees for admission to the Laboratory Class, exclusive of materials, are, for one month, £4 4s.; for three months, £10 10s.; for six months, £18 18s., &c.

EVENING CLASSES.

Classes for Evening Instruction are held at King's College from October to March, and during April, May, and June.

The Classes include one for the Elements of Chemistry and one for Practical Chemistry.

The fee for the former is £1 11s. 6d.; for the latter, £2 2s. The classes meet twice a week.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

17, Bloomsbury Square, W.C.

School of Pharmacy. The Session commences on October 1st, and extends to the end of July.

LECTURES ON CHEMISTRY AND PHARMACY, BY DR. REDWOOD.

These Lectures will be delivered on Monday, Tuesday, and Wednesday mornings, at 9 o'clock.

Part 1.—Physics in relation to Chemistry and Pharmacy.
" 2.—Chemistry of Inorganic Bodies.
" 3.—Chemistry of Organic Bodies.

Also Lectures on Botany and Materia Medica, by Professor Bentley. The first and second parts of this course, extending over the winter months, will be delivered at 17, Bloomsbury Square, on Friday and Saturday mornings, at 9 a.m. The third part of the course, on Systematic Botany, will be delivered at the Royal Botanic Gardens, Regent's Park, at 8 a.m.

Fees.—For registered apprentices and Associates of the Society, for either of the above courses, £1 1s.; for either part separately, 10s. 6d. For those not connected with the Society, £2 2s. for either of the above courses; £1 1s. for either part separately. Students have free admission to the Library and Museum.

Laboratory.—The suite of Laboratories for Practical Instruction in General and Pharmaceutical Chemistry will be opened on October 1st, under the direction of Professor Attfield, Ph.D. Fee for the entire Session of ten months, Twenty-five Guineas. The Laboratories are open from 9.30 a.m. till 5 p.m. Students can enter at any period during the Session.

Two Scholarships (the Jacob Bell Memorial Scholarship) of Thirty Pounds a year each, are open to competition annually in July.

The Board of Examiners meet monthly, and are required by the Pharmacy Act to examine "all candidates who may present themselves for examination in their knowledge of the Latin Language, in Botany, in Materia Medica, in Pharmaceutical and General Chemistry, and to grant Certificates of Competency."

CITY OF LONDON COLLEGE, LEADENHALL STREET, E.C.

The Annual Courses consist of three terms, each averaging ten Experimental Lectures. Fee, 5s. per term.

Subjects:—Junior Class, Chemistry—First year, Non-Metals; second year, Metals and (time permitting) Elements of Organic Chemistry. Senior Class, 7 to 8 p.m., Practical Analysis.

BIRKBECK LITERARY AND SCIENTIFIC INSTITUTION.

EVENING CLASSES.

Inorganic Chemistry—Mr. G. Chaloner. Tuesday, 8 to 9.

Practical Chemistry and Analysis—From 8 to 10, Saturday evenings.

ISLINGTON SCHOOL OF SCIENCE, WINDSOR STREET, ESSEX ROAD, N.

Evening Classes for Experimental Physics and Chemistry, with Laboratory practice on Wednesday and Friday evenings. Fee 5s. per course of Thirty Lessons. Teacher, Mr. J. Howard.

LADIES MEDICAL COLLEGE.

The Ladies' Medical College, established by the Female Medical Society in order to teach to educated women the theory and practice of Midwifery and the accessory branches of medicine.

President.—Lord Shaftesbury. *Hon. Sec.*—Dr. James Edmunds.

Elementary Chemistry.—Lecturer, Mr. J. A. R. Newlands.

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SUPPLEMENT
TO THE
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THE STUDY OF CHEMISTRY.

Chemistry may be studied as a means to an end, and as an end. The importance of chemistry to every kind of manufacture has become fully acknowledged as not only affording many improvements, but as a means of economy. But to the chemical manufacturer, as well as to the purely scientific chemist, the advanced study of chemistry is the end of their labours; yet in both instances the routine pursued by the students may be the same, the difference being one of degree of attainment. We say that the routine may be the same, for we cannot recognise the method of committing to memory some text-book as being at all worthy of the name of a course of scientific study. Such a method is perhaps suited to the debating society, where the casual employment of a hard name bears an indefinite effect, but is certainly not calculated to supply knowledge that either would satisfy a conscientious examiner or be of material worth. There is, then, left two methods of study, differing, as has been said, only in degree—(1) study by attendance in class on experimental lectures, with *viva voce* instruction; (2) study, either singly or collectively, in a laboratory under a practical chemist. These methods bear to each other a relation somewhat similar to that existing between clinical medicine as studied in the hospital and in practice, or between book-keeping learnt at school and pursued in the office. The first method may precede the second with advantage, but alone it will rarely lead to thorough comprehension of the science, because the student is so much dependent upon the reasoning of his Professor, that for practical work by himself he remains quite unprepared, unless the second method should have been to some, and even slight, extent supplementary. There are, too, so many points of detail that fix themselves indelibly in the memory during a course of laboratory work, to which hand and mind become alike accustomed, and which even the lapse of years will not obliterate. This view of chemical science, its consideration as a collection of experimentally-ascertained facts, is most essential to the student. A presently-received theory may in the course of years undergo such marked changes as to appear almost unrecognisable to those to whom the changes have passed unnoticed; but a fact—well, "a fact is a fact for ever"—and, once made, by experiment, the student's own, is equally ever afterwards an inalienable property. It has unfortunately been a course too often adopted to ask, of students qualifying for science certificates, a merely theoretical knowledge of their subject. But several instances could be indicated where there is a growing tendency to test the knowledge of the candidate experimentally and practically. And that this tendency meets with encouragement, from the students themselves as well as from examiners, is evidenced by the transference of the principal source of our chemical instruction from the School of Mines and Oxford Street to larger lecture-rooms at South Kensington, as well as by the foundation of institutions such as the College of Physical Science recently established at Birmingham. The student of to-day enjoys the further advantage of a course of chemical instruction—elementary it may be—during his school days, especially if he be intended to attempt an Oxford or Cambridge Local Examination, elementary examinations that are eminently practical in their nature. That the importance of early culture in scientific enquiry is becoming duly recognised is also evident from the impetus given to science studies at the somewhat exclusive Universities of Oxford and Cambridge. From the former seat of learning we have been accustomed to hear from the lips of the Wayn-flete Professor brilliant elucidations of the most intricate reasoning on chemical subjects, and it is not without pleasure that we note the acceptance of the chair by Dr. Odling, F.R.S., whose practical teaching at the Royal Institution has met with so much favour. At Cambridge, the election of a Science Tripos is an act of to-day. At the Universities of London, Dublin, Edinburgh, Glasgow, and others, the science classes were never so well attended and the candidates for scientific distinction so numerous. And it is interesting to notice that the attention bestowed upon chemistry is far above that given to any one other subject of scientific study, arising doubtless from the manner in which chemistry, owing to the numerous discoveries of the last decade, is fast becoming an integral part of other applied science. A knowledge of chemistry is now almost as essential to the engineer as to the chemist. In naval architecture, recent events have proved that the disregard of molecular action may be attended with awkward consequences; while the highest branches of chemical enquiry are brought in to aid in the improvement of the material itself of which our vessels are constructed. To enumerate the results of the application of chemistry to manufacture during the last century would be to record more brilliant triumphs than are to be found in the annals of Ancient Greece and Rome. Who would not endeavour to follow, however distantly, in the footsteps of such men as Faraday, Wollaston, and others of the day whose names are household words?

Turning from the higher branches, we have the classes for instruction in science under the direction of the Committee of Council of Education, in which the artisan may gain an acquaintance with the rudiments of chemistry. The teaching of these classes has always been practical, and its benefit, although felt but only indirectly, is none the more real; and that it is fully appreciated is shown by the eagerness with which the testimonials of the Department are sought.

Medical and toxicological chemistry, a branch spreading widely from the parent tree, is, from the increased delicacy of means of determination, now able to prepare or detect the most subtle medicines and poisons with an accuracy formerly unthought of. Chemistry, in short, must now rank as one of the exact sciences, as it is one of the most important; and without doubt it has arrived at its present stage of advancement by means of a careful discrimination and a close attention to *fact*.

In placing before our Students this number of the Chemical News, specially devoted to them, and in recommending to their notice the curricula of the several schools, we admonish them to a practical, or rather, should we say, experimental, course of study in the science they have chosen.

THE SEWAGE COMMITTEE OF THE BRITISH ASSOCIATION.

PRACTICALLY the Gun-Cotton Committee of the British Association was Professor Abel, and now practically the Sewage Committee is Mr. Hope. That Mr. Hope's sewage-farm at Romford is skilfully and advantageously worked, and more especially shows the merits of sewage irrigation, strikingly set forth and contrasted with other ways of disposing of sewage, may be, and we believe is, essentially true—but why this should be, as it appears to be, the sole accepted mission of the Committee of the British Association on the Treatment and Utilisation of Sewage, is not so clear.

It will possibly be within the knowledge of some of our readers that in the year 1870 this Committee collected £1530 from various towns in the United Kingdom, and so became possessed of a sum of money equal to the collective amount which the British Association spends annually upon all its committees.

At the recent meeting of the Association in Brighton, the Sewage Committee announced that it had expended all its money and applied to be re-appointed, and for a grant of £100 from the general fund of the Association. Furthermore, there was an intimation that a repetition is contemplated of its appeal to the towns for pecuniary assistance.

Under these circumstances, the history and doings of this Committee are of public interest; and, indeed, one of the leading London papers has publicly remonstrated with the leader of Her Majesty's Opposition in the House of Commons, for not taking part in "the great sewage debate" in Section B.

Here we may observe, in passing, that curiously enough the very occurrence of this great sewage debate appears to be contrary to the rules, or at any rate to the ordinary course of procedure, in the Sections, of the British Association, and that we are indebted for it to the public spirit and sense of right of the President, Dr. Gladstone, who, resisting official pressure, put the question to the Chemical Section on the Tuesday, whether or not there should be a sewage debate on the Wednesday. The question was answered unanimously in the affirmative by the members of the Section, and accordingly the debate came off.

The Sewage Committee of the British Association began very humbly at the Norwich meeting in the year 1868 with a grant of £10. In the following year it was re-appointed in Exeter, and received a grant of £50; and between that meeting and the meeting in the summer of 1870, as already described, it executed the feat of collecting £1530 from the towns.

The Committee appointed in Exeter, in 1869, consisted of Mr. Grantham, Mr. Denton, Mr. Harrison, Mr. Hope, Dr. Paul, and Professor Wanklyn; and was constituted "without power to add to its number." It nevertheless added Professor Williamson and some others, and appealed to the towns for funds. A question then arose with the Committee as to the application of the money. One party maintained that members of the Committee were bound to work for the Committee, and that the payment of personal expenses, while actually thus engaged, was a legitimate application of the funds. The other party maintained that the members were not bound to work, and that the receipt of personal expenses would not be sanctioned by the British Association. The dispute related mainly to the chemical work, and was between the two chemists who had been appointed at the Exeter meeting, and who wished to work, and the other chemist subsequently appended. The dispute grew, and was complicated by the further question whether a committee, without explicitly getting power to add to its members, could exercise such a power? and the Council of the Association was appealed to, and decided that all Committees of the Association have power to add to their number, whether they are constituted "with power" or not.

In this way Professor Williamson, the chemist appended by the Committee, triumphed over Dr. Paul and Professor Wanklyn, the chemists appointed by the Exeter meeting of the Association. At Dr. Williamson's suggestion, and in opposition to the protest of Messrs. Paul and Wanklyn, a former assistant of his, viz., Dr. Russell, at that time of St. Mary's Hospital, and at present of St. Bartholomew's, was nominated chemist to the Committee.

Messrs. Paul and Wanklyn thereupon issued a circular to the subscribing towns respecting this transaction, stating that the question put to the subscribing towns was whether the main work of the Committee was to be done by its members at an unremunerative rate, or by friends of the Committeemen at a remunerative rate. Many towns returned answers favourable to Messrs. Paul and Wanklyn, but not having sufficient support within the Committee, they protested, and left the field to Dr. Williamson, who, in conjunction with his nominee, Dr. Russell, is responsible for the chemical work of the Committee.

Of the six members of the Sewage Committee appointed in 1869 by the British Association in Exeter, only Mr. Grantham, who was chairman, and Mr. Hope, who is proprietor of a sewage-farm on which the Committee make experiments, remain in a state of activity. Of the other four members three have withdrawn, and one, viz., Mr. Harrison, has become passive. Tracing the history of the Committee, we find that it reported and was re-appointed in Liverpool in 1870; that it reported and was re-appointed in Edinburgh in 1871; and again in Brighton in 1872. Confining ourselves to the events in Brighton, we have to record that attention was called to the circumstance of this Committee applying to the sectional Committee of the Mechanical Section of the British Association for recommendation to be re-elected, before its report had been read, in the Section; that after the reading of the report discussion was forbidden, as being contrary to the rule of the Association; and that efforts were made to prevent the discussion of it in the Chemical Section, but that they were frustrated by the determination of the President and the action of the Section. When the debate came off, considerable distrust of the accuracy of the work done was expressed in some quarters. The report itself was strongly in favour of irrigation.—*Mechanic's Magazine.*

CHLOROPHYLL AND ITS RELATION TO LIGHT.*

By Professor LOMMEL.

IT is well known that green plants decompose the carbonic acid in the atmosphere, retaining the carbon and giving back the oxygen. This assimilation of carbon takes place in the chlorophyll cells under the influence of light. The chlorophyll will not effect it without light of fitting quality and intensity; the light will not effect it where there is no chlorophyll. Hence it is important to study the relation of chlorophyll to light.

Two optical properties of chlorophyll may here be considered: its *absorption* of light, and its *fluorescence*.

To study the former, an alcohol or ether solution of chlorophyll is placed between the source of light and the slit of a spectroscope. The position of the absorption-bands may be compared with that of Fraünhofer's lines.

Where there is much thickness of liquid, or the solution is a strongly-concentrated one, the extreme red only appears; the rest is absorbed. On further dilution, green, yellow, and orange successively appear. A solution from fresh leaves gives a spectrum with the following characteristics:—Immediately after B, in the middle of the red, is a dark band extending a little beyond C; this

* Abstract of a Paper in *Poggendorff's Annalen.*

may be numbered I. Another weaker absorption-band appears in the orange-yellow, half way between C and D (II.), a third (III.) in the greenish yellow after D, a fourth (IV.) in the green immediately before E. The order now given is also that of their intensity. The rest of the spectrum from before F is absorbed. Only, in certain cases, a slight weakening of the absorption appears about G, which may thus be regarded as the dividing line between two very broad absorption-bands, numbered by Hagenbach VI. and VII. Hagenbach's line No. V. is one which only appears from a solution that has been standing some time; it is situated between B and F.

Next, as to fluorescence. When a solution of green leaves is placed in sunlight or candlelight, *e.g.*, it shines with a peculiar dark red light, which may be intensified if the incident light is concentrated by a lens, and then the liquid appears as if self-luminous. To ascertain which part of the incident light caused this appearance, a solar spectrum was cast on the surface of the solution. The red gleam appeared throughout the extent of the spectrum from a little before B to the ultra violet part, and with varying intensity. Seven bright bands were discernible, and each of these corresponded, in position and intensity, to a dark band of the seven perceived in the former absorption spectrum. (Or, if No. V. be discarded, which only appeared in the modified solution, then VI. and VII. became one.)

The fluorescent spectrum was then, by means of a cylindrical lens, contracted to a narrow band, and this was examined through a prism with the refracting surface parallel to the spectral band. The spectrum of this "diverted" fluorescent light contained only red rays, with a refrangibility corresponding to that of the rays between B and C in the solar spectrum.

We thus learn that only the rays of light which are liable to absorption produce fluorescence in the solution, and the fluorescence is proportional to this liability. Further, the fluorescence may be called forth by any homogeneous ray.

The connection between fluorescence and absorption may be here looked at a little more closely.

Euler established the principle that a substance absorbs all those rays of light with whose rate of vibrations the vibrations of its smallest particle can agree.

Each molecule of a substance, according to its chemical structure, has certain determinate rates of vibration. If it is struck by a wave whose period agrees with one of those proper to itself, it is set in motion, or has its motion strengthened, if it has already been vibrating. The wave gives up its energy, partly or wholly, to the molecule, goes through the substance weakened, or does not go through at all, *i.e.*, it is absorbed.

Other vibrations, not agreeing with those of which the molecule is capable, pass through. We have an analogous case in Resonance. It must further be pointed out, however, that wave motion may also be absorbed when the molecule's rate of vibration is only half as great, or twice as great, as that in the wave; or, to use acoustical language, when it is an *octave* lower, or an *octave* higher, than the impinging wave. This may be called the principle of *indirect*, and the former that of *direct*, absorption. Such indirect absorption, as may be supposed, commonly exceeds the direct in energy, and absorption through the lower octave is generally greater than that through the higher.

Once more, a molecule is commonly capable, not of one kind of vibration only, but of various, which are more or less readily excited; and in whatever way the molecule is put into vibration, all those vibrations will take place simultaneously which are proper to it. In acoustics, there is the analogous case of *obertöne*, or overtones.

We have, then, the principle, that when a molecule, through direct or indirect absorption, is put in vibratory motion, it vibrates not only in the vibration-period of the absorbed wave, but the other vibrations proper to the molecule are conjoined with this.

Thus we may see how the chlorophyll molecule acts. We perceive that it is capable of vibrating in the vibration-period of the rays between B and C and the next octave below, while it vibrates only in the next lower octave of the more refrangible rays. In the former case there is direct and indirect absorption, in the latter only indirect. In those parts of the spectrum with whose vibration-period, or the next lower octave, the chlorophyll molecule readily agrees, there are dark absorption-bands. The dark bands in blue and violet arise from the molecule vibrating with half the vibration-period of the blue and violet rays; while, in the case of the bands between B and C, the molecule vibrates not only with half the vibration-period of the red rays, but also with the same vibration-period.

The molecule, set in vibration, itself sends out rays, one portion of which have rates of vibration half as great as those of the rays from B to the violet end of the spectrum, and another, rates equal to those of the rays between B and C. The former are not perceived, being in the ultra-red; the latter are perceived as red fluorescent light.

Hence may be understood how every absorbed ray, whatever its colour, produces only red fluorescent light; how the bright fluorescence bands correspond to the dark absorption-bands; and how the extreme red before B, which is not absorbed, also excites no fluorescence.

This theory is in opposition to that of Stokes, according to which every ray giving rise to fluorescence calls forth only such rays as have a rate of vibration inferior to its own. By the use of an alcohol solution of rose of Magdala, I have also been able to obtain yellow and greenish yellow rays from red rays. (An additional experiment confirmatory of the theory is here described.)

Chlorophyll in the leaf acts much in the same way, with reference to light, as chlorophyll in solution. It was found, however, that, on causing the light to pass through a single leaf, the absorption-bands II., III., and IV. (which appeared in the solution) were not present. There was strong absorption only in the red between B and C, and in the violet; chlorophyll in the solid state, moreover, gives no fluorescence.

If, now, we seek to answer the question, What kind of rays are most productive of the assimilation of carbon in the plant? it is clear, first of all, that only an absorbed ray can act chemically. The chemical action in the cell arises from the energy communicated on absorption of the ray. The most chemically-efficient ray must therefore be sought among those that are most easily and perfectly absorbed.

But it is also necessary to know the "mechanical intensity" of the ray. A ray that is not absorbed will not produce chemical action; and a ray which is perfectly absorbed produces but a small effect if its mechanical intensity is small.

Have we the means of measuring the mechanical intensity of sun-rays?

The luminosity of the ray, or its "physiological intensity," furnishes evidently no criterion; nor does the action of rays on salts of silver or explosive gas supply a proper criterion. Every ray may act chemically which is absorbed. Different substances absorb different rays; in one the red, in another the violet, produces chemical action. That the violet and ultra-violet rays act chemically, *e.g.*, on salts of silver, is no reason for distinguishing these as "chemical rays." The curve of so-called chemical intensity in the spectrum only indicates the relation of the rays to particular reagents.

We have, however, in lamp-black a substance with the aid of which the mechanical intensity of all rays may be estimated, since all kinds of rays are perfectly absorbed by it and their energy transformed into heat. By passing a thermopile, the end of which has been covered with lamp-black, along the solar spectrum, the mechanical intensity of the various rays can be measured. By this means it is ascertained that, in a spectrum formed through a rock-

salt prism, the heating power is at its maximum in the ultra-red: from there it decreases towards the violet end, where it is smallest.

For the assimilating action in plants, the most efficient rays are those which are most strongly absorbed by the chlorophyll, and at the same time have a high mechanical intensity or heating power. They are the red rays between B and C.

The blue and violet rays, though largely absorbed, are little operative, their mechanical intensity being small. The extreme red rays produce no chemical action, because they are not absorbed. The yellow rays, notwithstanding considerable mechanical intensity, are little operative, because they are very little absorbed. The same holds good for the orange and the green.

The experiments I have hitherto made on the assimilation power of plants in light of different colours have confirmed the foregoing statements, or at least have presented nothing in contradiction of them. These experiments can only with difficulty be compared with each other, as the mechanical intensity of the incident rays was left out of account. The thermo-multiplier must in future be regarded as a necessary instrument in any laboratory for the study of plant physiology.

Dr. Lommel concludes with a short account of some experiments by Professor Sachs, of Würtemburg, in which eaves were put in a glass tube containing a known amount of carbonic acid; this was enclosed in a glass receiver, which held a coloured solution, and thus exposed to sunlight. The decomposition of the carbonic acid was afterwards measured. In this way it was found that, with a chromate of potassium solution, which absorbs the more refrangible part of the spectrum and allows the rest to pass, including the efficient red rays between B and C, a marked decomposition took place; with a solution of ammoniac copper, on the other hand, which allows only the blue and violet to pass, and absorbs the remaining part of the spectrum, the action was very little. A chlorophyll solution, for the same reason, gave very little action, the red rays between B and C being absorbed.

ON SOME NEW METHODS OF ANALYSING ETHERS.*

By J. ALFRED WANKLYN.

Two methods were proposed. The first consisted in saponifying the ether, and then measuring or weighing the alcohol formed during that operation. It is well known that the acid obtained on saponifying an ether may be titrated, and Professor Wanklyn showed some years ago that this determination may be made with a high degree of accuracy. The determination of the alcohol set free is, as will be observed, complementary to the determination of the acid.

In carrying out the new process, the following is the method of operation:—

A portion of the ether to be analysed is accurately weighed. 5 or 10 grms. may be conveniently taken. This is then sealed up with excess of aqueous solution of baryta, digested in the water-bath until the decomposition of the ether is complete. The tube is then opened, the contents diluted with water and submitted to distillation—the distillate, consisting of weak alcohol is weighed, and its sp. gr. is taken.

Instead of baryta, it is possible to employ caustic potash in solution in alcohol; but in the latter case it is necessary to use a known quantity of alcohol, which must afterwards be taken into account, being subtracted from the total amount of alcohol which distils over at the termination of the experiment.

The author expects that these estimations of the alcohol evolved on saponification of ethers will prove to be very precise, and that indeed they should be among the most accurate determinations in organic chemistry. That the saponification of an ether can be effected with precision is quite certain. That weak alcohol can be distilled off excess of alkali with precision, the authors experiments on ethylate of soda have proved.

The second process of analysis proposed by Professor Wanklyn is to decompose the ethers by means of excess of strong hydriodic acid. This is especially designed for the fats which are salts of glycerine, and which ought to yield Erlenmeyer's iodide of isopropyl. By this means it is hoped that the percentage of glycerine derivable from any given fat may be estimated. There is a little uncertainty how the acid evolved from a fat will behave towards excess of hydriodic acid, or towards iodine, phosphorus, and water, and this point awaits experiment. The author proposes to examine butter by this process.

* Abstract of a paper read before the British Association, Brighton Meeting, Section B.

NOTICES OF BOOKS.

The Hygiene of Air and Water. Being a popular account of the Effects of the Impurities of Air and Water, their Detection, and the Modes of Remedying them. By WILLIAM PROCTER, M.D., F.C.S. London: R. Hardwicke. 1872.

THIS work gives a clear and simple statement of the injurious effects produced on health by impure air and water. It treats of the various means of detecting the impurities, and gives many useful tests in common language; we quote one of practical value:—"A weak solution is made of permanganate of potash, or Condy's (crimson) fluid, which is a similar solution, is diluted—either of them is the test solution. Take half a pint or more of the water to be examined, previously acidified by the addition of a few drops of hydrochloric acid, or about 12 drops of sulphuric acid (oil of vitriol) diluted with 5 parts of water; add the test solution, drop by drop, whilst stirring, until a faint pink tinge is perceptible. Every 15 minutes the water is to be looked at, and as the colour disappears, a few drops more of the test solution cautiously added, and this is to be continued until the colour remains permanent for half an hour. All the organic matter is then destroyed (oxidised), and the quantity of solution required to effect this gives a rough estimate of the matter originally in the water. The change of colour is better observed by placing the vessel upon a sheet of white paper before a window, and looking down at the paper through the liquid. This is a simple process, and it is within the power of all to ascertain the fitness of our water supply for dietetic purposes." The remainder of the work is equally simple, and as highly valuable in character.

TO CORRESPONDENTS.

*** We cordially thank those gentlemen who so kindly acceded to our request, in sending us the necessary information respecting the Chemical and Medical Schools for our Students' Number.

J. Spiller writes to complain of the adoption, without acknowledgment, in M. Emile Kopp's paper on "Processes for Distinguishing and Separating Silk, Wool, and Vegetable Fibres in Mixed Tissues," published in our issue of the 30th of August, of the specific test for silk which he brought before the Liverpool Meeting of the British Association in 1870.

W. F. White.—Attfield's "Chemistry," published by Van Voorst, or Squire's "Companion to the British Pharmacopœia," published by Churchill.

Luxor.—Hassall's "Adulterations in Food and Drink," or Duflos's Works. See Reviews in vol. xxiii. of CHEMICAL NEWS.

E. Sonstadt.—Thanks for your communication.

C. R. C. Tichborne.—Received.

London: Printed and Published by the Proprietor, WILLIAM CROOKES, at the Office, Boy Court, Ludgate Hill, E.C. Friday, September 13, 1872.

ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

Chemical Department.

Professor.—A. H. Church, M.A. Oxon.

Assistant.—E. Kinch, F.C.S.

The Autumn Session commenced on the 14th of August; it divides on the 6th of October, and terminates about the 20th of December.

The Chemical Instruction comprises Three Courses of Lectures and Laboratory Practice:—

(1). 32 Lectures on Inorganic Chemistry.
(2). 32 Lectures on Organic Chemistry.
(3). 24 Lectures on Agricultural Chemistry.
(4). 32 Lessons on Chemical Manipulation.
(5). 32 Lessons on Qualitative Analysis.
(6). 32 (or more) Lessons on Quantitative Analysis.

Catechetical Lectures are also given, while analyses of manures, oil-cakes, minerals, soils, waters, &c., are daily performed in the College Laboratories, and Chemico-Agricultural researches undertaken by the more advanced Students, under the immediate direction of Professor Church.

The text-books used are Church's "Laboratory Guide," Roscoe's "Chemistry," and Church and Dyer's edition of "How Crops Grow."

LIVERPOOL ROYAL INFIRMARY SCHOOL OF MEDICINE.

Lecturer on Chemistry and Toxicology,—Dr. J. Campbell Brown.

Course of 100 Lectures. Monday, Tuesday, Thursday, and Friday, at 10.15. £5 5s.

Technological and other non-Medical Students may take out any of the divisions separately—Fee, £1 1s., but no certificates will be given until the whole course has been attended.

Practical Chemistry.—It is expected that the new Laboratories will be open in November for the reception of Students, when those who desire to prosecute practical Chemistry, analysis, or original research, will be provided each with a separate working bench and cupboard, with tests, fuel, water, and gas. Fees, from £2 2s. to £10 10s. per quarter.

Summer Practical Chemistry Course. Fee £3 3s.

A Class for the Practical study of Organic Chemistry will be formed during either the Winter or Summer Session—Fee, £3 3s., including materials and apparatus.

Gentlemen who are not Students of the School are also admitted to the Laboratory and Lectures.

The Laboratory is open daily from 10 to 4 (except Saturday), for the study of Practical Chemistry, and for Analysis.

ANALYTICAL LABORATORY AND SCHOOL OF TECHNICAL CHEMISTRY.

7 and 9, Hackin's Hey, Liverpool.

Conducted by Mr. A. Norman Tate.

A limited number only of pupils received. Hours of attendance, 9.30 a.m. to 5 p.m. (Saturdays, 9.30 a.m. to 1 p.m.). Pupils may enter at any time and for any term.

Fees—Three months, £15 15s.; six months, £26 6s.; twelve months, £52 10s.

The Laboratory is also open from October to end of April two evenings per week for practical work.

Lectures one evening each week.

A separate working bench is provided for each Student, and he is also supplied with all ordinary chemicals, gas, fuel, and the more substantial portions of Laboratory apparatus, but must provide himself with test-tubes, beakers, and other apparatus of a fragile nature.

In addition to the ordinary chemical studies, the course of instruction will, as far as possible, comprise all such studies as may be required for the successful prosecution of the particular branch or branches of Applied Chemistry in which the pupil is to engage; as, for example, in the case of one intended for manufacturing pursuits, he would study architectural and mechanical drawing, so far as is required for the preparation of plans, &c., of chemical apparatus and manufactories, the nature and use of building materials, and the scientific principles and practical rules involved in building and constructive operations, and other scientific and practical information required in the arrangement, construction, and management of chemical manufactories, and the application of Chemistry to industrial pursuits.

COLLEGE OF CHEMISTRY, LIVERPOOL.

Founder.—Dr. Muspratt, M.D., &c.

Principal.—Mr. Martin Murphy, F.C.S., Professor of Chemistry.

The Course of Instruction given in the College of Chemistry comprises the teaching of Chemistry as a science, and the general application of chemical knowledge; also the teaching of the principles of those branches of physics which are allied with chemistry, such as light, heat, electricity, &c.

Particular attention is devoted to instruction in the practice of systematic analytical operations, whereby students will be enabled to determine accurately the general and proximate constituents of substances, and so arrive at a knowledge of their nature and properties.

Instruction in the application of chemical data to medicine and agriculture, and to the chemical and metallurgical operations, comprising Technology, will be given, to qualify students for these avocations.

The students will invariably be controlled and directed in their study and work by the Principal and competent assistants. Ample laboratory accommodation is provided for students, and such general appliances as will facilitate their progress in acquiring a knowledge of the specialities taught in the college.

The student's laboratories are open throughout the year. Hours of attendance—From 10 a.m. to 5 p.m. daily.

Fees—10 guineas per quarter of 3 months, or 35 guineas per annum, payable in advance. Students provide al their own apparatus and books.

Medical and Pharmaceutical students are admitted for 1 hour per day. Fee for 3 months, £2 2s.

A Course of Lectures will be delivered to the students during the winter months. Evening Classes.

Certificates of attendance recognised by the University and Apothecaries' Hall of London, and Apothecaries' Hall of Ireland.

LEEDS SCHOOL OF MEDICINE.

Winter Session.

Lecturer.—Mr. J. Chapman Wilson, F.C.S.

Daily, except Wednesday and Saturday, at 11 a.m. First session, £4 4s. Second Session, £3 3s.

Summer Session.

Practical Chemistry.—Mr. Wilson, F.C.S.

Mondays and Tuesdays, 9.30 to 11. Each course, £3 3s.

General Chemical Students.—The Laboratories are open daily, under the direction of Mr. Wilson, for the instruction of General Students in Chemical Manipulation, Technical Chemistry, and all branches of analysis; and also for the use of gentlemen wishing to pursue special chemical researches.

The fees, payable in advance to the Treasurer, are as follows:—For one month, £4 4s.; for two months, £7 7s.; for three months, £10 10s.; for four months, £13 13s.; for five months, £15 15s.; for six months, £17 17s.; for nine months, £21. Special fees will be charged to Students who do not wish to work every day in the week.

The Chemical Museum contains minerals, metallic ores and metals, rare chemical substances, and illustrations of the most important chemical manufactures in their different stages.

Curator.—Mr. Scattergood.

LEEDS MECHANICS' INSTITUTION AND LITERARY SOCIETY'S LABORATORY.

Chemical Classes and Laboratory for Instruction in Elementary, Practical, and Analytical Chemistry.

Lecturer.—Mr. George Ward, F.C.S., with Assistants.

HIGH HARROGATE COLLEGE, YORKSHIRE.

Professor of Chemistry.—Mr. W. G. Mason, F.C.S., Certificated Science Teacher.

MANCHESTER GRAMMAR SCHOOL.

CHEMICAL DEPARTMENT.

Professor.—Francis Jones.

Instruction is given in Inorganic Chemistry, Organic Chemistry, Metallurgy, and Analytical Chemistry. There is a lecture-room and second laboratory, affording accommodation for seventy-two Students.

MANCHESTER ROYAL SCHOOL OF MEDICINE.

(INCORPORATED WITH OWEN'S COLLEGE).

Lecturer on Chemistry.—Mr. Daniel Stone.

The usual Course for the Medical Boards.

A Laboratory is connected with the School.

OWEN'S COLLEGE, MANCHESTER.

Chemistry.—Professor H. E. Roscoe, B.A., Ph.D., F.R.S., F.C.S.

Senior Assistant.—Mr. C. Schorlemmer, F.R.S.

Junior Assistant.—Mr. Henry A. Smith, F.C.S.

Junior Class.—Wednesday and Saturday, from 9.15 to 10.15 a.m.

Subject: Inorganic Chemistry, comprising the laws of chemical combination, and a description of the properties and mode of preparation of the non-metallic elementary bodies and their most important compounds.

Senior Class.—Tuesday and Thursday, from 9.15 to 10.15 a.m.

Subjects: Inorganic and Organic Chemistry, including the properties of the metals and their compounds, and the composition and relations of the best defined groups of organic bodies, and the laws regulating their formation.

Students are expected to answer the written exercises and attend the *viva voce* examinations given in these Classes.

Fee—For each Class, £3 3s.; for both Classes, £5 5s.

A Recapitulatory Lecture, without additional Fee, will be given on Friday at 9.15 a.m., which members of both Classes will be required to attend.

Organic Chemistry (Extended Course).—Wednesday, from 3 to 4 p.m., and Friday, from 4 to 5 p.m.

This Course, on the Chemistry of the Carbon Compounds, in which the subject of Organic Chemistry will be completely treated, will be given by Mr. C. Schorlemmer, F.R.S.

Fee, £3 3s.

Extra Class.—Wednesday, from 4 to 5 p.m.

Subject: Technological Chemistry.

The Chemical Principles involved in the most important Chemical Manufactures will be chiefly considered in this Course.

Students attending this Class must be acquainted with the principles of Chemical Science. Fee, £2 2s.

Analytical and Practical Chemistry.

LABORATORY COURSE.

Professor.—Henry E. Roscoe, B.A., Ph.D., F.R.S.

Senior Assistant.—Mr. C. Schorlemmer, F.R.S.

The aim of this Course is to make the Student practically acquainted with Chemical Science, to enable him to conduct analysis and original research, and to fit him for applying the Science to the higher branches of Art, Manufactures, and Agriculture. To accomplish this, an attendance of not less than four days per week during three whole sessions is as a rule necessary. It is very advisable that each Laboratory Student should attend or should have attended the Course of Lectures on Theoretica Chemistry,

The College Laboratory will be open for Students daily from 10.30 a.m. until 5 p.m., except Saturdays, when it will be closed at 1.30. The Laboratory is closed from 1.15 until 2, for dinner.

The Laboratory is fitted with every convenience for the prosecution of practical chemistry, all branches of qualitative and quantitative analysis, and original research.

Each Student is provided with a separate working table, set of tests, fuel, water, and gas, free of expense; but he is required to find his own apparatus, a few of the more expensive reagents, and the chemicals required for his experiments. Other apparatus or instruments of a more expensive description may be obtained on loan from the Laboratory Steward, subject to regulations to be prescribed by the Professor.

Fees for the Session.—Students working six days per week, £21; ditto, four days, £17 17s.; ditto, three days, £13 13s.; ditto, two days, £9 9s.; ditto, one day, £5 5s. Students entering the Laboratory Class at or after Christmas, for not less than two days per week, will be charged two-thirds of the fees for the whole session.

Special Fees for Shorter Periods.—For six months, six days per week, £17 17s.; five months, ditto, £15 15s.; four months, ditto, £13 13s.; three months, ditto, £10 10s.; two months, ditto, £7 7s.; one month, ditto, £4 4s.

Lectures on the methods of Qualitative and Quantitative Analysis, intended to supplement the instruction in Practical Chemistry, will be given by Mr. C. Schorlemmer, F.R.S., on Mondays, from 4 to 5 p.m.

First year's Laboratory Students are recommended to attend and answer the written exercises and the *viva voce* questions given in this Class. Fee, £1 11s. 6d.

Chemical Calculations.—In this Class, instruction and special practice is given by Mr. C. Schorlemmer, F.R.S., on Wednesday, from 4 to 5 p.m., in the methods of Chemical Calculations, serving as supplementary to the Lecture and Laboratory Courses. Fee, £1 1s.

The Lectures on Chemistry in Owen's College are recognised by the University of London for its Medical Degrees, by the Royal College of Surgeons, and by the Apothecaries' Hall.

EVENING CLASSES.

Chemistry.

First Lecture Course.—(The Non-Metallic Elements).—Professor Roscoe. Monday, from 8.30 to 9.35 p.m.

Second Lecture Course.—(The Metals).—Mr. Smith. Friday, from 8.35 to 9.35 p.m.

Third Lecture Course.—(Organic Chemistry).—Mr. Schorlemmer. Thursday, from 8.35 to 9.35 p.m.

Laboratory Courses.—Professor Roscoe, Mr. Schorlemmer, and Mr. Smith. Monday, from 6 to 8.30 p.m.

COLLEGE OF PHYSICAL SCIENCE, NEWCASTLE.

(IN CONNECTION WITH THE UNIVERSITY OF DURHAM).

Professor of Chemistry.—A. Freire-Marreco, M.A.

Junior Division—General Principles of Chemistry; History of the non-metallic Elements.

History of the Metals and their more important compounds; Principles of Qualitative Analysis, Monday, Wednesday, and Friday at 11 a.m.

Senior Division—Elements of Organic Chemistry, Tuesdays, at 11 a.m. Applied Chemistry, Thursdays, at 11 a.m. Fee £5 5s.

Practical Chemistry.—The Laboratory is open from 10 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturday, when it closes at 1 p.m.

Laboratory Fees.—Students working six days per week, five guineas per term. Students working alternate days, three guineas per term. Students working one day per week, one guinea per term.

Evening Classes—Inorganic Chemistry, Mondays, at 8, commencing November 4, 1872.

SHEFFIELD SCHOOL OF CHEMISTRY.
1 and 3, Surrey Street, Sheffield.

Mr. A. H. Allen, F.C.S., delivers a Course of Thirty Lectures on Inorganic Chemistry and Metallurgy. Day and Evening Classes for the practice of Analytical Chemistry and Assaying.

SHEFFIELD SCHOOL OF MEDICINE.

A Course of Forty-Five Lectures on Inorganic and Organic Chemistry will be delivered during the Winter Session, by A. H. Allen, F.C.S.

The Summer Course of Practical Chemistry is conducted by Mr. Allen.

SCOTLAND.

UNIVERSITY OF EDINBURGH.

Professor of Chemistry.—Dr. A. Crum Brown, F.R.S.

ROYAL COLLEGE OF PHYSICIANS AND SURGEONS, EDINBURGH.

Lecturer on Chemistry.—Dr. Stevenson Macadam, F.R.S.E.

The Courses of Instruction in Chemistry include its applications to Medicine, Agriculture, and the Industrial Arts; and they qualify for the University of Edinburgh and other Universities, the Royal Colleges of Physicians and Surgeons, the Navy, Army, and Indian Medical Service, and the other Medical and Public Boards.

The Lectures on Chemistry are delivered daily during the five months of the Winter Session. The Lectures form a complete Course, and special Lectures on Technological Chemistry are given. Tutorial Class Examinations are held during the Session.

The Instructions in Analytical Chemistry are conducted in the Laboratories at Surgeons' Hall, which are now open daily, under the personal superintendence of Dr. Macadam, for the instruction of gentlemen in Chemical Analysis, and the prosecution of researches in Manipulative Chemistry.

The Prelections in Practical Chemistry are also conducted in the Laboratories at Surgeons' Hall. The subjects selected for Examination are those with which Medical Students are specially called upon to exhibit a practical acquaintance.

Fees.—Lecture, £3 5s. (University Graduation, £4 4s.) Practical Chemistry (University, &c.), £3 3s.; Analytical Chemistry, £2 per month, £5 for three months, or £10 for six months.

UNIVERSITY OF GLASGOW.

Professor of Chemistry and Practical Chemistry.—Dr. Thomas Anderson, F.R.S.E.

ANDERSONIAN UNIVERSITY, GLASGOW.

Professor of Scientific Chemistry.—Dr. T. E. Thorpe.

GLASGOW MECHANICS' INSTITUTION.

Professor of Chemistry and Practical Chemistry.—Dr. R. Carter Moffat.

GLASGOW VETERINARY COLLEGE.

Professor of Chemistry.—Dr. R. Carter Moffat.

SCHOOL OF CHEMISTRY,
42, Bath Street, Glasgow.

Dr. Wallace, Mr. Tatlock, and Dr. Clark.

Scientific course of Lectures on Inorganic and Organic Chemistry, by Dr. Clark. From 12 till 1 daily. Commencing Tuesday, November 5. Fee for the course, £2 2s.

Laboratory Instruction in Analytical and Practical Chemistry, from 10 till 4 daily, Saturdays excepted. Commencing Tuesday, November 5. Fee for Six months, exclusive of apparatus, £8 8s.

Private Pupils, number limited to Three, £26 5s., for six months.

Evening course of Laboratory Instruction in Analytical and Practical Chemistry. Tuesday and Thursday, from 7 p.m. till 9.30 p.m. Commencing November 5. Fee for one night per week, £1 1s. per quarter. Two nights per week, £2 2s. per quarter.

Evening course of Lectures on Chemistry, in connection with the Practical Class, by Mr. Tatlock. Every Friday, from 8 p.m. till 9 p.m. Commencing November 8. Fee for the six months' course, 5s.

Spring course of Practical Medical Chemistry, by Dr. Clark. Commencing Tuesday, January 8. Fee, £2 2s.

Summer course of Practical Medical Chemistry, by Dr. Clark. Commencing Tuesday, May 5. Fee, £2 2s.

IRELAND.

DUBLIN.—TRINITY COLLEGE.

Professor of Chemistry.—Dr. Apjohn, F.R.S.

ROYAL COLLEGE OF SURGEONS, DUBLIN.

Professor of Chemistry.—Dr. Barker.

QUEEN'S COLLEGE, BELFAST.

Professor of Chemistry.—Dr. Andrews, F.R.S., &c.

QUEEN'S COLLEGE, GALWAY.

Professor of Chemistry.——Dr. T. H. Rowney.

A Laboratory for Practical Instruction is attached to all the Queen's Colleges. The usual Practical Course for the Medical Boards is given in the summer.

ROYAL COLLEGE OF SCIENCE FOR IRELAND.
Stephen's Green, Dublin.

This college supplies as far as practicable, a complete course of Instruction in Science, applicable to the Industrial Arts. The subjects of Instruction are:—Pure and Applied Mathematics, Descriptive Geometry, and Mechanical Drawing, Mechanism, Theoretical and Applied Chemistry, Chemical Analysis, Physics, Botany, Zoology, Geology, and Palæontology, Mineralogy, Mining, Machinery, Surveying, and Agriculture.

Professor of Theoretical Chemistry.—W. K. Sullivan, Ph.D., V.P.R.I.

Professor of Analytical and Applied Chemistry.—R. Galloway, F.C.S.

Assistant Chemist.—W. Plunkett, F.C.S.

A course of Lectures on Inorganic and Organic Chemistry is delivered by Dr. Sullivan three times a week during the Session. Fee for the entire course, £2.

A course of Lectures on Technological Chemistry is delivered by Mr. Galloway twice a week during the session. Fee for the course, £2.

The chemical and Metallurgical Laboratories, under the direction of Mr. Galloway, are open every week day during the session, except Saturday. Instruction is given in the different branches of Analytical Chemistry, including Assaying, and in the methods for performing Chemical research. Each student is taught, not in class, but separately and independently; and he is supplied with a separate working table, with reagents, fuel, water, gas, and the larger and more expensive apparatus. Fee, for the session of nine months, £12; or for three months, £5; or for one month, £2.

There are four Royal Scholarships, of the value of £50 each yearly, with free Education, including Laboratory Instruction, tenable for two years; two become vacant each year; they are given to students who have been a year in the College. There are also nine Exhibitions attached to the College, of the yearly value of £50 each, with free Education, including Laboratory Instruction, tenable for three years; three become vacant each year. These are awarded at the annual May Examinations of the Science and Art Department.

A Diploma of Associate of the College is granted at the end of the three years' Course.

The Session commences on Monday, October 7th.

ON NOCTILUCINE.

By Dr. T. L. PHIPSON, F.C.S.

I have given the name of noctilucine to a peculiar organic substance, first alluded to in my paper in the *Comptes Rendus* for 1860 (2e semèstre, p. 541), and again in my work on "Phosphorescence" (London, 1862, p. 103), as the substance which causes the production of light in phosphorescent fish. This remarkable compound, which might almost be termed the *organic phosphorus*, is also the cause of the production of light by the glowworm, and probably by all other phosphorescent animals; it appears to be formed in a variety of circumstances at the expense of dead animal and vegetable tissue, and even by certain living plants (*Euphorbia*, *Agaricus*, &c.). My observations at present relate only to noctilucine as produced in the animal world.

At the ordinary summer temperature noctilucine is a semi-fluid, almost liquid, substance containing nitrogen; it is white, and in its natural state contains a considerable amount of water; it has a slight odour, resembling that of caprylic acid; it is only slightly soluble in water, and is somewhat lighter than this liquid; it is insoluble in alcohol and ether, and is decomposed by acids and alkalies. Nitric acid easily dissolves and decomposes it; sulphuric acid, also, and potash evolves ammonia from it. In fermenting, in contact with water, it produces an odour of putrid cheese; as long as it is moist, it absorbs oxygen and evolves carbonic acid in the air. When left to itself it dries up, in the course of a few hours, to thin, shining, translucent films, quite devoid of structure, and resembling the *mucine* of the common garden snail.

When recently produced noctilucine is highly phosphorescent, and this production of light is owing to oxidation in contact with the air. It also shines for a little time in water, as long as there is air in the water; it is rather more brilliant in oxygen gas, and still more brilliant in a south-west wind, which I find usually contains much ozone. This production of light ceases as soon as the oxidation is completely accomplished; but as long as the smallest amount of air adheres to it, it will shine, even in carbonic acid, for a short time.

Noctilucine is secreted in phosphorescent animals by a special organ, just as bile is secreted by the liver, and appears to be used in producing light nearly as fast as it is formed. It is also produced in certain conditions of temperature and moisture, in dead animal matter of various descriptions (pork-flesh, beef, blood, fish, &c.) and occasionally in urine. Whatsoever its source, it shows the same kind of light, nearly monochromatic; the same spectrum, principally developed between the lines E and F; and, as far as I have examined them, the same chemical properties.

In an impure state, noctilucine can be obtained from the surface of various fish when highly phosphorescent, also from the glowworm, by pressing the luminous matter collected by the scalpel through porous filtering-paper. It is secreted in a pure form by the luminous centipede (*Scolopendra electrica*), and on the 15th of September, 1871, I procured some from this source. When a number of these *Scolopendræ* are caused to run about a large glass capsule, they leave a certain amount of noctilucine upon the surface of it, sufficient to enable one to examine the principal properties of this curious substance.

The secretion of noctilucine in the higher phosphorescent animals, such as the glowworm and the firefly, is to a certain extent dependent upon the nervous system of these insects; hence they have the faculty, apparently, of shutting off their light at will. In this case the secretion is stopped for the time; but a certain quantity of noctilucine exists in the eggs of the glowworm, which also shine for some time after they are deposited.

There appears to be a special organ for the secretion of noctilucine, even in the minute *Noctiluca miliaris* of the English Channel, and other lower types of phosphorescent animals; and even here, where we find scarcely any rudiments of a nervous system, the secretion of the luminous substance appears to depend greatly upon external circumstances.

DIDYMIUM IN BRITISH MINERALS.

By A. H. CHURCH, M.A., F.C.S.

Didymium was first discovered in a British mineral by Mr. C. Greville Williams, F.R.S., in the year 1865. This fact is recorded in the Chemical News, vol. xii., p. 183. The mineral containing this rare metal was described by me as "a new British mineral containing cerium." Analyses proved it to be a hydrated phosphate of the cerium metals, the latter, calculated as cerous oxide, constituting no less than 51·9 per cent of the mineral. Specimens of this mineral may be seen in the British Museum, Mineral Case No. 57. It is, however, very rare, and I hesitated to sacrifice the specimens which I possess in order to attempt a precise estimation of each of the cerium metals present. It occurred in a Cornish copper lode on quartz and killas. A concise description of the species will be found in Dana's "Mineralogy," p. 555, (5th Edition, 1868).

The above remarks were suggested by Mr. C. Horner's note on the presence of didymium in pyromorphite (Chemical News, vol. xxvi., p. —). The occurrence of cryptolite in certain British, as well as foreign specimens of apatite has been ascertained. Now as crypotolite is an anhydrous phosphate of the cerium metals, it may be considered that the discovery of this species in apatite is equivalent to the detection of didymium in that mineral. I must say I have failed to find even a trace of cryptolite in the true asparagus-stone, the beautiful greenish-yellow crystals of apatite, from Juniella, in Murcia, Spain.

Mr. Horner's discovery of didymium in pyromorphite will naturally lead to the search for the other cerium metals in that mineral.

Isopurpuric Acid and Salts as Dye Materials.—According to the recent researches of Dr. E. Kopp, isopurpurate of potassa is best obtained by treating an intimate mixture of picric acid and cyanide of potassium, first with a small quantity of cold water, and after this mixture has been left standing for about half an hour, more water is added and the temperature raised to from 40° to 45°; after cooling, the mass is purified according to Hlasiwetz's process. The best mordants for isopurpurates on silk and wool are mercuric and lead salts; the hue of the colours produced differs from that of those produced from murexide under the same conditions, inasmuch as the isopurpurates yield a magnificent purple with a somewhat brownish orange hue. The colour is fast as regards sunlight and sulphurous acid, both of which destroy murexide colours. While murexide-zinc yields a beautiful yellow, isopurpurate of zinc yields deep red, somewhat brownish, hues. Murexide colours do not stand acids and alkalies at all; these reagents render isopurpurate colours somewhat yellow. The alkaline isopurpurates are explosive salts, but the purpurates are not; many reagents decompose these salts entirely, giving rise to the formation of secondary compounds. Isopurpurate of potassa is more advantageously prepared by causing the cyanide of potassium to act upon the picrate of ammonia.

THE CHEMICAL NEWS.

Vol. XXVI. No. 669.

OFFICERS OF HEALTH.

The onerous duties attached to the public position of a Medical Officer of Health render it necessary to consider whether our present system is the best that could be devised. Under the Public Health Act of this year it has been enacted that, for the approval of one of Her Majesty's Principal Secretaries of State, is to be substituted the direction of the Local Government Board in the appointment and removal of analysts. Whether this new *régime* will bring and maintain competent men in the several official positions remains to be seen; but it appears to greatly interfere with the independence of the Officer, who may be exposed to much annoyance and opposition. No one will dispute that the independence of the Officer is a point of the highest importance, and that it should be secured at any cost to the administration. The Officer should be adequately salaried, in order that he may devote his entire energy to the duties of his office; and consequently his appointment should have the permanency necessary to ensure that there may be no fear as to the future.

We have next to consider the qualifications required for the proper discharge of the duties of the office. Not only is it required that the Officer should possess high medical testimonials, he must also be an accurate analyst in the most difficult branches of chemical science. He must be well versed in the detection of poisonous agents and impurities in food, in the water supplied to the community; while, besides his ordinary medical education, the candidate should be expected to have given special attention to the laws of hygiene and of contagious diseases. The question arises, whether one man can be considered to attain to an adequate knowledge of these various branches of science. It is generally held that chemistry alone is the study of a lifetime, while "young" doctors are rarely regarded with a favourable eye. We have, then, ample reason for an innovation, to consist in the separation of the offices of Medical Officer and Analyst. Were these offices distinct, yet worked in partnership, there would even then be sufficient work for each officer. To any one in the least conversant with chemical processes, and the length of time and repetition necessary to an accurate determination, it must appear ridiculous to suppose that the multifarious duties of a Medical Officer of Health can be undertaken by one person with any chance of accuracy in detail. Everyone will therefore be in favour of the movement now set on foot in the parish of St. George's, Hanover Square, where it is proposed to divide the duties of the Medical Officer of Health between two, a medical man and a chemist. The chemist who offers himself is Dr. Dupré, Lecturer on Chemistry at Westminster Hospital; while the medical profession is represented by Dr. R. J. Lee, M.A., M.D. Cantab, Lecturer on Forensic Medicine at the Westminster Hospital. It is to be hoped that these gentlemen will meet with success in their candidature, not only on account of their eminence in their professions, but for the principle which their joint appeal to the parishioners of St. George's involves. The present system, though admirably carried out by some men who have sacrificed themselves to their office, to be placed in some instances under the control of Boards slow to recognise their important services, is daily shown to be susceptible of improvement. The time for improvement has now arrived, and remains in the hands of the vestrymen of St. George's, from which Board, composed chiefly of enlightened men, we may expect, if not acceptance of the proposition now laid before the members, at least reasons for the refusal, or that some modification of the existing system should be suggested.

It will be seen at once that this is far from being a local question; it is one affecting the public generally. The epidemics which have appeared amongst us from time to time having been proved capable of eradification, and the cause having been made apparent, the prevention is attainable, and, we think, lies now in the hands of the public themselves.

THE PRECIPITATION OF SILVER BY COPPER.*

By ALFRED TRIBE, F.C.S.

When a piece of copper foil is metallically connected into a piece of silver, and placed into an aqueous solution of cupric nitrate (dilute to about 6 per cent) containing air, the oxygen of the latter slowly combines with the copper of the nitrate, forming cuprous oxide, which deposits on the silver in a fine crystalline condition, whilst the nitric element combines with metallic copper, reproducing the nitrate. If the copper have its surface covered with crystalline silver, the decomposition of cupric nitrate by free oxygen is accelerated, so much so that, when this couple is moistened with the salt and exposed to air or oxygen, the tips of the silver crystals become at once coated with cuprous oxide; and when a limited quantity of air is used, nitrogen only remains in the free condition (Gladstone and Tribe, *Proc. Roy. Soc.*, vol. xx., p. 290).

In carrying out the above and other experiments, it was frequently necessary to completely precipitate silver from the nitrate by copper, and it was observed that the metal so obtained, after being washed with water, invariably contained copper, sometimes in considerable quantity. Since the above-mentioned couple is formed the instant silver in solution is brought into contact with copper, the idea suggested itself that the copper found in silver precipitated by that metal might be due to dissolved oxygen in the silver solutions; or to the absorption of that gas, by the liquid, from the air during or subsequent to the precipitation of the metal. The experiments made with the view of ascertaining the correctness of this supposition are tabulated below.

There was employed in each experiment an excess of copper, and in experiments C to I about the same volume of liquid. In A and B, pieces of copper of the same dimensions were placed in open basins and covered to about a quarter of an inch with ordinary silver nitrate, *i.e.*, impregnated with air. In C, D, and E, bottles were filled with ordinary silver solution and stoppered during the precipitation. In F and G, carbonic anhydride was bubbled through the solutions prior to the immersion of the copper plate, and the precipitation conducted as in C, D, and E. In H and I ordinary solutions were employed.

* Read before the British Association, Brighton Meeting, Section B.

Experiment.	Per cent of $AgNO_3$ in Solution.	Duration in Hours.	Copper in Precipitated Metal.	Copper per 100 parts of Precipitated Metal.
A.	1·4	24	0·0185	7·45
B.	1·4	48	0·0377	15·23
C.	3·5	24	0·0103	0·32
D.	1·4	24	0·0096	0·77
E.	0·7	24	0·0099	1·61
F.	3·5	24	0·0025	0·08
G.	1·4	24	0·0029	0·23
H.	3·5	½	merest trace	—
I.	3·5	1/10	,, ,,	—

It appears, from experiments A, B, and D, that the quantity of copper is increased by exposing the couple covered with a solution of cupric nitrate to the air, and diminished by precipitating in closed vessels. The actual amounts of copper in C, D, and E being nearly the same, indicate that its presence cannot be attributed to oxygen in the copper employed; and, moreover, is a result which would follow were it caused by dissolved oxygen in the silver solutions, since it is probable they each contained about the same quantity of the gas. Experiments F and G show that the effect of saturating the solutions with carbonic anhydride prior to precipitation is to diminish the amount of copper three to four times, which doubtless is due to the partial displacement of oxygen by the more soluble gas. In experiments C to G, there existed a trace of silver in solution after the twenty-four hours. H and I, being of short duration, an excess remained; and it is noticeable that, in every case where the silver was nearly exhausted, copper was found, whereas, where there was an excess in solution, the merest trace only of copper existed in the precipitated metal.

It appears from the foregoing experiments that free oxygen is intimately connected with the presence of copper in silver precipitated by that metal; but, whether copper exists therein as cuprous oxide or as basic nitrate, would depend upon at what stage of the operation the oxygen plays its part. If the two actions, *i.e.*, decomposition of silver nitrate by copper, and cupric nitrate by oxygen, be simultaneous, basic nitrate should be found. If, however, the decomposition of cupric nitrate be not effected until the silver nitrate is so exhausted as to be incapable of action on the produced cuprous oxide, that substance should be found. One experiment made on this point with a weak solution of silver nitrate, seemed to show that basic nitrate of copper did not exist.

INFLUENCE OF CHANGES IN BAROMETRIC PRESSURE ON ANIMAL LIFE.

M. Bert continues, in *Comptes Rendus*, his account of researches on this subject.

Having previously shown that the effects produced on animals by changes in barometric pressure were due almost exclusively to the action of the surrounding oxygen (where the air was not confined), he proceeds to describe some experiments with reference to the effect of diminution of pressure on gases contained in the arterial blood.

His mode of experiment was, briefly, as follows:—The animal (a dog) was put in a sheet-iron chamber having several light ports, and fastened to one of its sides. An artery was uncovered and pinched (so as to interrupt the flow) by pincers which could be manipulated from without the chamber. A tube was introduced into the artery, and it extended to the outside, giving a passage for the blood. The chamber was then carefully closed, and the pressure gradually diminished with the aid of a steam-engine. By an arrangement of tubes and cocks, a current of air chemically pure could be kept up about the animal. The pressure in the apparatus could be reduced to 15 centimetres.

The blood was withdrawn with the aid of a syringe connected with the artery-tube, the pincers having been opened. M. Bert here points out an accident which precautions must be taken to avoid, viz., the passage of air into the animal from without, when the pressure has been reduced to a certain point.

The artery chosen was generally a carotid, sometimes a femoral, and the idea that there is a great difference in the blood of these arteries, as regards richness in oxygen, is considered by M. Bert erroneous.

The gases were extracted from the blood by M. Alvergniat's mercury-pump.

M. Bert gives a table of numbers, showing (in cubic centimetres) the volume of the gases per cent (centimetres) of the blood for various pressures. He makes the following inferences from the numbers obtained:—

(1). When the pressure diminishes, the quantity of gas contained in the blood also diminishes. Hence, when a man rises in a balloon, or climbs a mountain, the quantity of oxygen in his blood, for animating the tissues and compensating expenditure of force, becomes smaller and smaller, and, by and bye, insufficient, so that he cannot pass a certain limit without asphyxia. A similar diminution takes place in the carbonic acid, though the consequences of this are not so intelligible. It is at least an erroneous assertion (sometimes made) that the functional sufferings experienced on high mountains are due to intoxication by carbonic acid dissolved in too great proportion in the blood, seeing the proportion of this gas always diminishes with the barometric pressure, whatever the animal's motions.

(2). The diminution in the proportion of oxygen becomes manifest from 20 centimetres' diminution of pressure. And yet these are conditions in which millions of human beings actually live, *e.g.*, on the Mexican plateau of the Anahuac. They are, to use the expression of Dr. Jourdanet, who has studied the physiological effects of such conditions, *anoxyemics*; and the objections which have been urged to his ideas regarding them fall away before direct analysis of the gases in the blood.

(3). In most cases, the oxygen diminishes in greater proportion than the carbonic acid. But there were, in this respect, and in respect of absolute diminution, differences in different animals which are not easily explained: differences which doubtless exist in human beings also, and may partly account for the fact that some men can bear with impunity diminutions of pressure under which others become ill and unfit for work. Taking, as an example, a pressure of 36 centimetres, the loss of oxygen was, in four separate cases, 36, 38, 42, and 56 per cent. Carbonic acid presents more irregularities than oxygen.

(4). The chemical combinations of gases in the blood are dissociated very readily, and in a progressive manner, under the influence of diminution of pressure, and it is remarkable that such diminution takes place more readily in the organism than in experiments made *in vitro*.

M. Bert has hitherto treated of gentle and gradual changes of barometric pressure. He next makes a digression to consider the dangerous consequences of sudden changes in the direction of *decompression*. The fact of such danger is well known in the experiences of workmen who work under pressure, such as divers, who, in many cases, have suffered sharp local pains, paraplegia, paralysis, and even death from this cause. M. Bert cites two explanations which have been given of such effects. One is that of M. Rameaux, who considers that the normal gases of the blood, being dissolved in greater quantity in the liquid at high pressure, return to the gaseous state when the pressure is reduced, obstructing the passage in the blood vessels, and causing the same danger as an injection of air into the veins. M. Bouchard takes a different view; he thinks that when the intestinal gases, diminished in volume through pressure, and replaced in part by the blood, which then tends to the abdomen, expand suddenly on decompression, the blood is violently driven through the circulatory system, and the sudden irruption produces

in various organs, especially the nervous centres, apoplexy and congestion.

M. Bert put a healthy cat in a large receiver, the pressure in which was then raised to 8 atmospheres in about half an hour. A large cock was then suddenly opened, and equilibrium ensued in a few minutes. The apparatus was opened, and the animal came out apparently uninjured; but in about ten minutes it was seized with complete paraplegia, along with paralysis of the bladder. The urine contained blood and spermatozoids. Next day, this state continued, and the paralysis made progress. The animal was then killed, and the dorso-lumbar region of the spinal cord was found soft, like cream, without, however, any trace of sanguineous effusion or congestion.

Having in no case met with such a state of the nervous centres as M. Bouchard's hypothesis supposes, M. Bert also found the other hypothesis confirmed by the observation of numerous small bubbles of gas disengaged in the blood on decompression. He analysed this gas, and found it composed of 70 to 90 per cent nitrogen, the rest carbonic acid.

According to the pressure, and the rapidity of decompression, the gas may be suddenly liberated in large quantity, or may only pass to the aëriform state by bubbles more or less numerous. In the former case, circulation being arrested, death ensues almost instantaneously, the animal giving some cries and convulsions. The heart and vessels (especially the right side of the heart and the venous system) are then found filled with a kind of froth. The capillaries are injected with gas.

In the latter case, the phenomena vary according to the point at which the gaseous bubbles come to arrest the circulation; sometimes there is only a temporary pain, or failure of locomotion; but very often there was paraplegia, or paralysis, or cerebral disorder, with rolling of the eyes and symptoms of madness. Sometimes even death took place.

In no case in which paralysis had lasted more than an hour was it curable, though the animal sometimes continued to live eight days after. On examination, it was always found that the dorso-lumbar region had been the first attacked, the spinal cord being then softened. The rapidity of this softening, through arrest of circulation, M. Bert considers an important fact for pathological physiology. When the pressure did not exceed 5 atmospheres, decompression might take place in two or three minutes without apparent injury; from 6 atmospheres disorders were caused, and from above 7 atmospheres these always became fatal. When the maximum pressure of the apparatus was produced (19 atmospheres), paralysis and death could not be avoided, unless by extremely gentle decompression. Five minutes per atmosphere was not sufficient to prevent serious injury. Slight and short paralysis was sometimes even caused in a decompression of ten minutes per atmosphere, in descending from 10 atmospheres to the normal pressure.

The foregoing facts, obtained from experiment with dogs, cats, and rabbits, may, to a certain extent, be applied in the hygiene of divers and others working under pressure. Thus, for about 3 atmospheres sudden decompression is not very dangerous, but from 5 atmospheres the danger increases rapidly; and if divers are brought rapidly up from a depth of 70 or 80 metres, the consequences may be fatal.

Returning to the composition of gases in the blood, M. Bert gives the results of experiments in which animals were subjected to pressures above the normal. A dog was fastened in the interior of a metallic chamber, in which the pressure could be raised to 10 atmospheres at a rate of about five minutes per atmosphere. The blood was drawn from the carotid by a method similar to that already described. Such blood was always redder than the blood from the same part at normal pressure; and from about 4 or 5 atmospheres upwards it contained a number of small isolated bubbles.

The gases were afterwards extracted, and a table o numbers is given, from which M. Bert makes the following deductions:—

(1). The richness of the blood in oxygen increases with the pressure; but the increase is very small, and contrasts with the diminution of oxygen where the pressure was diminished. This would seem to indicate that the combination of oxygen with hæmoglobin is at the maximum of saturation, when the pressure is about normal; and for higher pressures, the small additional quantity of oxygen is probably dissolved in the plasma.

(2). The proportion of carbonic acid is not at all affected by increase of pressure; though, as has been seen, it diminishes when the pressure is reduced. M. Bert explains this by the decrease, in percentage proportion, of the carbonic acid in the pulmonary cavities when the pressure is increased, so that its pressure remains the same, and therefore also the quantity of carbonic acid which it maintains in the blood continues the same. In the opposite case (of pressure reduced), the carbonic acid in the lung cavities decreases in pressure, and this is not compensated by increase in percentage proportion.

(3). The proportion of nitrogen increases considerably with the pressure, without exactly following Dalton's law.

A. B. M.

PYRO-GILDING AS COMPARED WITH WATER-GILDING.

By J. BAYNES THOMPSON.

The older method of gilding by means of gold amalgam (called water-gilding) produces excellent results—the colour is beautiful and the coating is lasting; but it has its drawbacks, as most things have—it is a dear method as compared with others, and it is unhealthy for the manipulator on account of the mercury fumes; moreover, it is only applicable to metals that will amalgamate, and therefore is not applicable at all to iron or steel.

When electro-gilding was first discovered, it was thought that this cheap and easy method of gilding would supersede the more expensive and unhealthy method of gilding by means of gold amalgam. This might have been so, and the electro-process did nearly supersede it at first, till it was found out that it was possible to put a mere film on the surface, and that a mere film only was usually put on. though this film could be made to look at first as well as that done by the older process of water-gilding; but there was usually not one-twentieth of the wear in it, not only on account of its thinness, but also on account of its softness. By the old amalgamating process it was not possible to put a film on the surface, for the gold was amalgamated into the surface of the article gilded, and if too small a quantity of the amalgam was applied, then on "burning-out" the mercury, the gold was hidden in the metal of the article gilded, so that there must be a sufficient quantity applied to stand the "burning-out" of the mercury. This is the reason why the under metal does not tarnish through water-gilding as it does through electro-gilding and the older wash-gilding. In fact, electro-gilding has so degenerated, that no better results are expected from it than from the old dipping process, which is simply depositing a film of gold on the article by chemical action through dipping it in a solution of gold that will act chemically on the article. But iron and steel cannot be gilded by dipping, though it be in a solution of gold which will act on the iron or steel, because the gold is thrown down in powder with the salt of iron mixed with it, and will wipe off. Though gold and most other metals can be deposited in a reguline form on iron and steel, as indeed they can on black-lead and other forms of carbon, yet the coatings will not adhere, for the reasons before stated in a description of pyro-plating. Now, if a sufficiently thick coating of gold could be afforded to make an independent sheath to

the article, it would then not come off till ruptured, though it would be still only a loose sheath, and would be a very bungling expedient; moreover, it is out of the question as regards gold and the other precious metals.

With copper this can be afforded; therefore it is resorted to when it is required to gild or silver iron or steel. But such articles are with difficulty polished without raising the coating; and if polishing be successfully accomplished, very shortly the coating blisters up, from the gases generated under it by the action and reaction of the copper, iron, and the salts between them, which always remain less or more according to the cleanness and porosity of the iron.

Thus it is seen that no method of gilding hitherto in use is applicable to steel or iron; but, for all metals that will amalgamate, no process is superior in result to water-gilding when a gilding thickness only is required, but then the cost is great and the process unhealthy. When a thicker coating is required on amalgamating metal, then the electro process or the pyro process may be used. Good results may be obtained by the electro process if carefully and conscientiously done; but by the pyro process good results must be obtained, for the gold is then put on in successive coatings, and each coating is burnt in before the succeeding coating is put on. By this method, there is no danger of the gold peeling after being finished, for if the process is not thoroughly carried out, it will peel in the furnace long before the heat is raised to 500°.

This method recommends itself more especially for gilding or plating with gold on iron and steel, as there is no other that will accomplish that; and it is superior for other metals, in some points, to any other process, to water-gilding in cheapness and healthiness, and to other methods in results.

The mode of operation is similar, in most respects, to pyro-silvering, which was described in this journal some time ago. The only difference is this: the gold is put on in successive coatings, while the silver is all put on at once. Even it is better to put silver on in successive coatings in many cases, and it is sometimes done, but it enhances the price of coating too much to be generally practised with silver; in the case of gilding it is absolutely necessary.

The process is this:—After the article has been thoroughly cleaned, mechanically and chemically, the first coating of gold is put on, which, to all appearance, is a perfect coating; but when it has passed through the furnace, if the article be of steel or iron, the gold has disappeared into the steel, &c., which appears just slightly tinged with yellow. The next coating, after being burnt in, changes from brilliant gold to a much paler tint; but the third coating comes out of the fire as brilliant as it went in, and this is the test that the gilding is complete. For gilding, nothing more is required but a good hard burnishing with a steel burnisher to harden and polish the gold; but if, for any special purpose, a thicker coating is required, as many more coatings are put on as are deemed necessary.

THOUGHTS ON THE CONSTITUTION OF MATTER.

By CHARLES THOMAS KINGZETT.

Chemistry teaches us that there are met with in nature sixty-five kinds of elementary matter; but it does not limit the number to sixty-five, as there may be elements as yet unknown—and there are two properties at least common to all elements, viz., weight and form.

It being one of the objects of chemistry to show the relations existing between different bodies, it was not at all unnatural that Prout should have pointed out what he considered to be *one* of these existing relations, which was "that the numbers which represent the combining proportions of the different elementary bodies are multiples by whole numbers of the combining proportion of hydrogen;" and the experiments of Dumas seemed to justify, to a certain extent, Prout's idea, although more recently Stas, by a series of most careful experiments, arrived at a different conclusion, viz., that there is no simple relation between the atomic weights. However this may be, one cannot help reflecting on other existing relations between elementary bodies, and thinking with Miller ("Inorganic Chemistry," vol. ii.), "it is not absolutely impossible that the various bodies at present regarded as elementary may, in reality, be compounds of a single primordial substance condensed in different degrees in the various so-called elements." And it is remarkable that this idea, in a modified sense, has existed in the minds of many of the greatest philosophers throughout all ages.

I now propose to state some of the considerations that lead to the conclusion that all matter, simple or compound (so-called), is constituted of one element under different molecular forces. We say that *this* body is different to *that* body because we know the properties of each are distinct or peculiar; but if by some operations a certain substance had its properties changed, the question arises, Should it be still regarded as the original substance?

Now, by the passage of electric sparks through moist air or oxygen, a body is formed which has a peculiar fishy smell, great oxidising power, and various other peculiar characteristics. In short, it is *transformed* into ozone, or the same matter under different molecular forces. And why should we question it as a transformation? for if a force, or forces, can cause the union of two elements, and the compound formed is no likeness of its constituents, why may not a force, or forces, act on *one* matter or element, and the resultant bear no likeness to the original matter?

Again, magnesic borate ($3MgO\text{-}4B_2O_3$), as found in nature, has no developed electric power; but, when it is heated, it is rendered electric. Here, then, a new property is conferred upon it. By some other methods, known or unknown, a second new property might be assigned, and a third, and so on till all its natural properties by which we originally knew it were changed. Should it still be regarded as boracite? I think not.

It is needless to multiply instances, as many parallel and more convincing cases will suggest themselves.

A second consideration, which leads to the conclusion that there is only one primordial substance, is the fact that many simple bodies have properties very much like those of each other. To quote the words of Miller, in regard to the halogens, "it is impossible not to be struck with the close analogy presented by the three elementary bodies, chlorine, bromine, and iodine, both in their uncombined state and in their compounds. The specific gravity, fusing-point, and boiling-point of these elements rise as the atomic weight increases," and "the intensity of their chemical activity decreases as the combining number increases."

See, also, how the metallic bodies fade into the non-metallic bodies, and animal life into vegetable life!

Such and other evidence seem to lead us to consider all the simple known and unknown substances to constitute a series, each member being connected or related to the next by a tie, or ties, and having, as a whole, a gradation of certain properties; each being composed of the same and only elemental matter, but each being differently operated upon by natural molecular forces. So that, on this view of matter, a compound would be formed by a uniting force between two or more such differently operated upon portions of elemental matter.

But then we are conflicted by the question sure to be asked, How do you suppose matter to have been operated upon so as to form different kinds? The answer is found in the fact that the forces which constitute the causes were created at the same time as matter was, for, as Dubois Reymond has said, "separately they do not exist."

"No force without matter: no matter without force," is an axiom; and this brings me to another point, viz., of

the interchangeableness of the forces. Heat can be changed into light, and electricity into heat, &c.; and if force admits of transformation, why should not matter, especially when we consider that matter and force are inseparable? It is pleasing to think that perhaps, after all, the dream of the old alchemist was not so wild as it is thought to be; and still more pleasing is it to think that some day it may possibly be realised.

But to return to the subject, iodine, when united with potassium as potassic iodide, will not form with starch its blue iodide; but, if chlorine-water be added, it is immediately formed. Why is this? Simply because when iodine is used, as in potassic iodide, it is under a peculiar force known as chemical affinity, which masks the property that it possesses when free. And so the original properties of elemental matter are merely hid, or modified by the play of the various forces; literally, therefore, oxygen is not an element solely, but an element *plus* the various forces that bestow upon it those properties which enable us to recognise it as oxygen, and distinct from hydrogen, &c.

The diamond, graphite, and charcoal are constituted of the same matter, though the qualities of each are very different—the difference arising from molecular arrangement, or in other words, from the ultimate particles being differently operated upon.

Finally, let us glance at isomerism in the sphere of organic chemistry. The radical methyl is CH_3. Ethylic hydride is C_2H_6. From methyl we can produce its compounds, but we cannot produce them from ethylic hydride; and yet the ultimate composition of the two bodies is the same. Yet we can burn all three forms of carbon into carbonic acid.

Again, propylic alcohol is isomeric with acetone, but yet they are not identical in their properties. So that, if it were asked, Why should some portions of elemental matter be operated upon so differently from others? it might be replied, For the same reason that you cannot get the compounds of methyl from ethylic hydride, and for the same reason that propylic alcohol and acetone are of the same composition and yet so different from the chemists' standpoint.

So that, on the supposition that all forces could be withdrawn, we should have matter reduced to simplicity.

DETERMINATION OF COMBINED CARBON IN STEEL BY THE COLORIMETRIC METHOD.*

By J. BLODGET BRITTON.

In the *Journal of the Franklin Institute* for May, 1870, there is published a description of a colorimeter, together with a modification of the method proposed by Professor Eggertz, for determining combined carbon in iron and steel.

An instrument of the kind there described, but of a little higher range, though in other respects not differing materially from the one originally made and used in the Iron-Master's Laboratory, I now submit to your inspection; and I propose, also, to make some determinations with it for the purpose of showing how quickly they may be made, and enabling you to form some judgment of what reliance can be placed in the results.

Professor Eggertz proposed only a single standard, and the solution to be tested should be diluted to exactly correspond in colour with that of the standard, and the per cent of carbon calculated after carefully noting and making allowance for the measures of water used in diluting.

In practice, difficulty was found in bringing the colour of the normal solution down to the exact shade of the standard, also other difficulties were met with in conducting the process, causing delay, and interfering with the accuracy of the results.

To materially overcome these, and after numerous attempts, an instrument such as is now before you suggested itself to me; and also I concluded to use a larger quantity of metal than directed by Eggertz, and in addition, to filter the solution from its insoluble matter before making the comparison; and, more recently, to use an acid of just such strength as would completely dissolve the metal without the application of heat. Experimenting with these changes from the original method, I obtained reasonably good results.

The instrument, you will observe, consists of a series of tubes, sixteen in number, two and a half inches long, and about half an inch in diameter, standing upright, and securely fastened in a light, portable walnut-wood frame, but separated one from the other so as to allow just sufficient space between, to place for comparison the tube containing the solution to be tested. The tubes are filled with water and alcohol coloured with roasted coffee, and hermetically sealed. The solutions have been accurately standardised; the one in the tube to the left has its colour to correspond exactly with one produced by 1 grm. of iron containing 0·05 per cent of combined carbon dissolved in 15 c.c. of nitric acid. The solution in the tube next to it has its colour to correspond with one produced by the same quantity of iron dissolved in the same measure of acid, but containing 0·07 per cent of combined carbon; and so with each of the other tubes increasing 0·02 per cent of carbon, coloured in regular succession to the right, the last reaching 0·35 per cent, as indicated by the figures on the upper rail of the instrument.

On the back of the instrument strong pure white paper is tightly stretched for the purpose of screening and diffusing the light, and making the difference in the shades of colour most apparent.

The process of making a determination is exceedingly simple, and may be completed in thirty minutes. 1 grm. of the metal finely divided, is put into a tube of about an inch and a half in diameter, and 8 inches long, with 15 c.c. of chemically pure nitric acid of 1·42 sp. gr., and 2 parts water. The solution is then filtered into a small tube of 4 inches long, and of precisely the same diameter as those in the colorimeter, and as soon as the temperature has become reduced to that of the atmosphere, the tube may be placed in the instrument, the comparison made, and the percentage of carbon at once read off.

While conducting my experiments I found that with three determinations there was usually no perceptible variation, though sometimes there was as much as 0·01 or 0·02 per cent due mainly to some of the metal remaining undissolved. I consider it important, however, that the operator should make his determinations always with a uniform weight of metal and measure of acid, and under like circumstances, and the same as when he made his standards. The acid used should be invariably of the same strength. A very strong acid acts imperfectly on the metal; one not quite so strong acts too violently, and causes too much loss of colour; while, on the other hand, a very dilute acid leaves much of the metal undissolved. I have obtained good results from one of the strength already indicated. From twenty to twenty-five minutes is usually sufficient time to dissolve the metal, and from three to five minutes more to filter. The metal should be in moderately fine division, and passed through a sieve of about 20 spaces to the inch, to insure a pretty uniform size of particles, and about the best suited for being acted on by the acid. The solution, which always becomes quite warm from the action of the acid on the metal, should be allowed to cool to the temperature of the atmosphere, and the colour to become fixed before the comparison is made; the cooling may be hastened by immersing the lower end of the tube in cold water; but a considerable time should not be lost, for after some hours,

* Explained and conducted before the American Institute of Mining Engineers, at the New York Meeting, May 22, 1872.

and sometimes less, a change occurs, and a gradual loss of colour becomes apparent, and for this reason a nitric acid solution of metal cannot be used for a standard.

I think that by observing these precautions, the operator can, after a little experience, obtain results by the method described, and with the so-called mild steels, sufficiently accurate for all ordinary metallurgical purposes, and, by using a number of tubes at the time, make more than a dozen determinations in an hour.

The speaker then proceeded, in the presence of the members, to make three determinations according to the method he described. When the solutions were filtered and ready for comparison, Professors T. Sterry Hunt and G. W. Maynard were asked to make the comparisons, and declare the results. The solutions were found to be alike in colour, and to be between 15 and 17 of the instrument. The amount of carbon in the metal had previously been accurately determined by another method, and found to contain a little over 16 per cent.

The speaker concluded his remarks by stating that he had carefully tried several of the combustion methods, but had found the one known as Ullgren's, with some modifications, to afford the most constant and reliable results, and he preferred it, in his own practice, when a high degree of accuracy was necessary.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 117).

Quercitron, Fustic, Persian Berries, Weld, Aloes, Turmeric, Annatto, Ilixanthine, Lo-kao, Tannin Matters—Gall Nuts, Sumach, Divi-Divi, Myrobalans, Catechu.

I SHALL have the pleasure of devoting the first part of this lecture to some of the most useful and important yellow substances used by dyers and calico-printers, and to one or two other colouring matters which, although scarcely commercially important, are interesting from a scientific point of view.

Among the most valuable of these bodies is *quercitron*, the bark (from which the epidermis has been removed) of a particular species of oak, called the *Quercus nigra* or *Quercus tinctoria*. This tree is indigenous to the United States of America, and is especially found in the forests of Pennsylvania, Georgia, and in North and South Carolina. A chemist, of the name of Bancroft, first introduced it to the English dyers in the year 1775. The most esteemed qualities are those imported from Philadelphia, New York, and Baltimore. The bark, after being removed from the tree, is dried, and ground between mill-stones. The value of a sample bears a direct ratio to the fineness of the powder, for the woody fibre of the bark, which contains only a small quantity of colouring principle, is not easily reduced to a fine powder.

M. Chevreul was the first chemist who examined this dye, and he found it to contain a peculiar tannin, which has since received the name of *quercitannic acid*, and a yellow colouring principle, to which he gave the name of *quercitrin*, but which has since received the name of *quercitric acid* from M. Bolley.

M. Chevreul, by boiling quercitron bark in water, and allowing the aqueous solution to stand, obtained fine, laminated crystals, which were gradually deposited, and to which he gave the name of quercitrin.

M. Bolley followed a better process. He treated the bark by alcohol, precipitated the tannin from the alcoholic solution by gelatine, evaporated the alcohol, and obtained the quercitron under the form of colourless crystals. These, under the influence of air or oxidising agents, assume a bright yellow colour. The alkalies give quercitron a brownish tint, but its most characteristic property is to give a greenish-yellow precipitate with chloride of iron, and a beautiful bright yellow precipitate with protochloride and oxymuriate of tin.

M. Rigaud discovered, a few years since, by boiling quercitron with water containing 10 per cent of sulphuric acid, that it is a glucoside, which decomposes under the influence of the acid into glucose and quercitrin according to the following formulæ:—

Quercitrin.	Water.	Glucose.	Quercitine.
$C_{36}H_{40}O_{21}$	+ $2H_2O$	= $2(C_6H_{12}O_6)$	+ $C_{24}H_{20}O_{11}$

Quercitrin is a crystalline powder, of a bright lemon colour, and of a much richer hue than quercitron. It has no taste, is insoluble in cold water, and only slightly soluble in hot, but is freety soluble in alcohol. It is soluble in alkalies, to which it communicates an orange-yellow hue. Its alcoholic solution gives orange precipitates with the salts of lime, baryta, and lead. It assumes an orange colour with perchloride of iron.

Although quercitron bark gives a fine yellow colour on woollen goods, when mordanted with salts of tin, to which has been added alum or cream of tartar, still its employment has greatly decreased of late years, owing to its colour assuming a reddish hue when exposed to the atmosphere.

Within the last twenty years, a preparation from it has been imported into this country from America, under the name of *flavine*, which in reality may be considered as commercial quercitine. It is now manufactured in England by two different processes. The first consists in boiling half a ton of quercitron bark with 63 lbs. of soda crystals, in about 2000 gallons of water; after boiling for about a quarter of an hour, 250 lbs. of concentrated oil of vitriol are added. The whole is then maintained at the boil for two hours, when it is run off on to woollen filters, washed until free from acid, pressed, and dried, and is ready for market. The second process, which I consider the better one, consists in boiling for two hours 100 parts of quercitron bark with 300 of water and 15 of oil of vitriol, and then washing, pressing, and drying, as in the first process. 100 parts of quercitron bark give 85 of flavine, which have a dyeing power equal to 250 parts of quercitron.

Flavine is not much employed in calico printing as a yellow dye, its principal use being to communicate a brown and orange hue to madder reds.

The best mode of estimating the value of a sample of quercitron bark or flavine, is to dye some mordanted cloth in the same way as in testing the value of a madder or garancine.

We shall now pass to the study of another colouring matter, called *old fustic*. The tree which supplies it is called *Morus tinctoria*, and grows in Madeira, Mexico, Jamaica, Cuba, and other islands of the West Indies. It arrives in this country in logs of various sizes. Dyers prefer those which are dense, are not worm-eaten, and which are of a fine orange-yellow tint in the inside.

In this case, again, my master, M. Chevreul, was the first to isolate the two colouring matters which the wood contained. To the first of these Wagner gave the name of *morintannic acid*, and to the second that of *moric acid*. To extract these, rasped fustic is boiled twice with water and the solution concentrated to the state of a syrup, when after a few days a crystalline deposit takes place, which is separated, washed rapidly with cold water, and pressed. To separate the two colour-giving principles, the pressed mass is treated with boiling water, which leaves the moric acid as an insoluble mass, while the morintannic acid is dissolved. The moric acid is treated with weak hydrochloric acid, to remove some lime salts; it is then dissolved in alcohol, from which it crystallises in the form of yellow needles. To obtain the morintannic acid which was dissolved, the solution is concentrated, when the colouring matter crystallises

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

out, and only requires re-crystallising once or twice from acidulated water to give it almost pure. It forms yellow crystals soluble in alcohol, which have the formula $C_{13}H_{10}O_6$. It gives a greenish black precipitate, with sulphate of protoxide of iron, and, with salts of lead, a yellow precipitate, soluble in acetic acid. It is decomposed by concentrated alkalies, and when boiled with zinc and sulphuric acid, the solution assumes a very bright red colour, due to the transformation of morintannic acid into two most interesting substances, *phloroglucine* and *machromine*.

Moric acid, though insoluble in water, is freely soluble in alcohol and ether, but is insoluble in bisulphuret of carbon. It is soluble in alkalies, to which it gives a yellow colour, and from this solution it is re-precipitated by the addition of an acid. Perchloride of iron communicates to its alcoholic solution an olive-green shade. It gives yellow precipitates with salts of zinc, tin, lead, and alumina, and a dark green precipitate with copper. It has the formula $C_{12}H_8O_5$.

Old fustic is especially employed for dyeing wools in yellow or olive-green shades. They are mordanted with a salt of alumina for yellow, or with a salt of iron for green. By the employment of salts of copper and other mordants a variety of shades can be obtained. It is much used by dyers, but only to a limited extent by calico printers.

Young fustic belongs to the same genus as sumach, of which I shall speak further on, and its botanical name is *Rhus cotinus*. It grows in the West Indies, and in France and the southern parts of Europe. It is found in commerce in the form of small logs and crooked branches. Young fustic contains a tannin matter and three colour-giving principles, a red, a brown, and a yellow. The yellow colouring matter, when isolated and crystallised, bears the name of *fustine*. It is soluble in water, alcohol, and ether. Alkalies communicate to it a fine orange hue. It rapidly oxidises when exposed to the atmosphere, assuming an orange colour. A decoction of the wood is affected by the alkalies and air in the same manner as fustine. It gives a bright orange precipitate with lime and baryta waters, and a similar coloured precipitate with chloride of tin. Persulphate of iron yields with it an olive-green precipitate. Young fustic dyes wool mordanted with salts of alumina a fine orange colour, but it is easily affected by light; its chief employment is in conjunction with cochineal, to the red colour of which it imparts a brilliant orange hue. It is much used in Turkey and the Tyrol by tanners to impart to their leather an orange-yellow colour.

Persian berries, which are extensively employed by woollen and mixed fabric dyers, calico printers, paper stainers, and leather dressers, are the berries or fruit of a genus of plants called *Nerprun*, which grows freely in France, Spain, Turkey, Persia, &c. Generally speaking, the berries are gathered before they are quite ripe, which is the reason why the berries, which are the size of a small pea, have a yellowish green shrivelled appearance. The berries only give good results when recently gathered; after one or two years they lose a great deal of their valne, not yielding to the dyer such brilliant hues. The yellower they are, the less price they command in the market. They bear among the dealers the names of the countries from which they are imported; thus there are Avignon berries, Spanish berries, Turkish berries, and Persian berries. The latter are the best, and are obtained from the *Rhamnus amygdalinus*. Among dyers and calico printers all the varieties are called Persian berries.

The yellow decoction of the berries assumes an orange-yellow tint with alkalies, which is not changed on the addition of an acid. Lime-water gives it a greenish hue, persulphate of iron a greenish yellow. Chloride of tin gives a greenish yellow colouration, and a slight precipitate.

Sir Robert Kane succeeded, some years ago, by treating the berries with ether, in extracting a substance, crystallising in fine golden yellow crystals, to which he gave the name *Chrysorhamnine*, and assigned to it the formula $C_{23}H_{11}O_{11}$. He found that, when a solution of this compound was boiled in the air or in presence of an oxidising agent, it became converted into a substance which he named *xanthorhamnine*, to which he gave the formula $C_{23}H_{12}O_{14}$.

Since then, several eminent chemists have examined into the nature of these colouring matters, among whom may be mentioned Gellaty, Bolley, and especially Lefort and Schützenberger.

From their researches the following facts may be gathered. Lefort, in 1866, succeeded in isolating two colouring matters from the berries, which he named *rhamnagine* and *rhamnine*. Rhamnagine is soluble in water, and may be obtained under the form of crystals, while rhamnine is an insoluble yellow amorphous powder. In researches, published in 1869, he found that rhamnagine was identical in composition with rhamnine, and that only a molecular change took place in the transformation of rhamnagine into rhamnine, such as we are all aware starch undergoes on conversion into dextrine. He supported this view by analyses, showing that both these substances had the same formula, namely, $C_{24}H_{32}O_{14}$. The researches of Schützenberger further proved that, under the influence of weak sulphuric acid, rhamnagine is decomposed into a peculiar sugar, and a substance to which he gave the name *rhamnatine*, thus showing that rhamnagine is a glucoside. The following formulæ show the decomposition which takes place:—

Rhamnagine.		Water.		Rhamnatine.		Sugar.
$C_{24}H_{32}O_{14}$	+	$3H_2O$	=	$C_{12}H_{10}O_5$	+	$2(C_6H_{14}O_6)$.

From these results it would appear that the real colour-giving principle is rhamnagine, and that rhamnine and rhamnatine, which are insoluble in water, are only products of decomposition.

Decoction of Persian berries is principally used in print works for producing bright yellows and greens, on prepared tin cloth, in steam styles. To obtain yellows, the extract is mixed either with a little red mordant (sulpho-acetate of alumina), or with a little muriate of tin. The mixture is thickened, printed on, and the fabric is steamed. To produce greens, the decoction of berries is mixed with prussiate of tin, the mixture is thickened and printed on the fabric, which is then steamed, when the yellow of the berries and the Prussian blue which is formed, unite to produce green on the fabric. The decoction of berries is very apt to enter into fermentative decomposition, and thereby become ropy; this may be prevented by the addition of a little carbolic acid.

A very fine brilliant yellow lake is produced from a decoction of Persian berries, the manufacture of which was kept secret for a long period by the Dutch. It consists in adding pure carbonate of lime to the decoction, when the lime salt falls, carrying with it the colouring matter of the decoction. The yellow lake thus produced is moulded into small lumps, which are dried in the shade.

There is a variety of mignonette which used to be cultivated in England and France, called weld, its botanical name being *Reseda luteola*. This plant yields a most valuable yellow dye when fixed on wool by means of alum, not only because the colour is exceedingly brilliant, but because it is very solid, resisting light, heat, and acids. Alkalies only communicate to it a slight orange tint. Its colouring matter was extracted by M. Chevreul many years ago, and he gave it the name of *luteoline*. He obtained it in yellow transparent crytals. By the action of oxidising agents, such as bichromate of potash, it assumes a magnificent yellow tint, indentical to that produced with it in cotton fabrics.

M. Moldenhauer has since studied luteoline, to which he assigned the formula $C_{20}H_{14}O_8$. It is slightly soluble in water, but very soluble in alcohol. It dissolves without decomposition in strong sulphuric acid, and yields, even when greatly diluted with water, a fine green colour with perchloride of iron. Schützenberger, who has lately studied this body, states that when mixed with water and heated to a temperature of 480° F. in sealed glass tubes, it decomposes into what he considers pure luteoline and resin. The luteoline is found in crystals adhering to the sides of the tube, while the resin collects at the bottom. He states, also, that if a decoction of the berries is boiled with weak sulphuric acid, a new yellow colouring matter is produced, which possesses a high dyeing power as well as a pure yellow hue.

The introduction of quercitron and flavine is the principal reason why weld has nearly disappeared from the market.

Aloes is imported into Europe from Bombay, Barbadoes, Jamaica, and the Cape of Good Hope, in the form of resinous masses, varying considerably in size. It is the dried sap or juice of several varieties of aloes, of the family of *Asphodels*.

Dr. Stenhouse, who has examined this substance, has succeeded in isolating two compounds; one, which crystallises in yellow prismatic needles, is soluble in cold water and alkalies, the solution having an orange tint. It has an intensely bitter taste. He has given it the name *alöine* and assigns to it the formula $C_{17}H_{18}O_7$.

The second compound, which may be considered as the resin of aloes, has received the name of aloëtine. Dr. Schunck has produced from aloes a yellow dye, called *chrysammic acid*, which will probably be yet extensively used. It is prepared by heating in a water-bath 8 parts of nitric acid with 1 of aloes; when the violence of the action has ceased, a second part of aloes is added. The application of heat is continued until hyponitric fumes cease to be given off. The mass is then poured slowly into a large bulk of water. The chrysammic acid falls in flakes to the bottom of the vessel. These are washed with water, until it assumes a fine purple colour. The formula of this acid is $C_7H_{22}(NO_2)O_2$. It forms small golden-yellow scales, soluble in alcohol and ether. Although but sparingly soluble in water, it communicates to it a magnificent purple tint, and its dyeing power is considerable. Mr. Saac has made a great number of dyeing experiments with chrysammic acid, and has produced with it a variety of shades. He believes that one day they will become commercial.

Turmeric is the tube or underground stem of the *Curcuma longa*, a plant which grows abundantly in the East Indies. It is imported principally from Bombay, Java, Batavia, and Barbadoes. That from Bombay is the most valuable. It is ground and sold to the dyers in the state of a fine powder of a remarkably brilliant orange hue, and of a strong odour. Vogel and Pelletier succeeded in extracting from it a colouring matter, to which they gave the name of *curcumine*. M. Lepage has, however, given the best process for its extraction. The ground roots are treated with bisulphuret of carbon, which dissolves a volatile oil and resinous matters. The root is then dried and acted on by a weak alkaline solution, which dissolves the curcumine. To liberate it, the alkaline solution is neutralised with an acid, when the curcumine falls as a precipitate. This is collected, dried, and dissolved in ether, from which it separates under the form of small brown scales, which yield on trituration a brilliant yellow powder.

Turmeric is seldom used as a dye, owing to its colour being so easily affected by alkalies, a fact well known to chemists, as they often employ it to ascertain the presence of a trace of free alkali or boracic acid in solutions. It is used in India to flavour rice, and by the natives to colour their skin red.

(To be continued).

OBITUARY.

JOHN CARGILL BROUGH.

It is with no formal expressions of regret that we announce the death of Mr. Brough. That he was a man of great refinement and intellectual culture was evinced by the ability he displayed as Editor of the *Chemist and Druggist*, the *Ironmonger*, the *Year-Book of Pharmacy*, and sub-editor of *Nature*; but failing health rendered it necessary for him to relinquish positions he had filled with so much credit. The promoters of the *Laboratory* could hardly have found a more energetic Editor than Mr. Brough, and in his hands that journal bid fair to become a formidable rival of the CHEMICAL NEWS; in spite, however, of his untiring zeal the *Laboratory* was not successful; but Mr. Brough was ever the most courteous of opponents. Some time before his death he became principal Librarian of the London Institution, and broken in health as he was, he did much to increase its usefulness, and won the esteem of all with whom he came in contact.

NOTICES OF BOOKS.

On Food. By H. LETHEBY, M.B., M.A., Ph.D., &c., Professor of Chemistry in the College of the London Hospital, and Medical Officer of Health, and Food Analyst for the City of London. Second edition, enlarged and improved. London: Bailliere, Tindall, and Cox. 1872.

THE Cantor Lectures delivered in January and February, 1868, by Dr. Letheby, on food, its varieties, chemical composition, nutritive value, comparative digestibility, physiological functions and uses, preparation, culinary treatment, adulteration, &c., were deservedly popular; and we are glad to see that a second edition has been published, now that the work has for some time been out of print. This second edition contains several important amendments, and if possible is even more valuable than the former.

CORRESPONDENCE.

ASSAY OF PYRITES FOR GOLD.

To the Editor of the Chemical News.

SIR,—As you have done me the honour to print in your Journal for August 9, 1872, my article on the "Assay of Pyrites for Gold," I beg leave to say that I hope the method I have there described will be examined by all chemists interested in this kind of work, and that it will be criticised as sharply as it deserves.

On what its value depends I am unable to say. I have sometimes thought that the interior of the crucible being filled all the time with an atmosphere of CO_2, it may be that the sulphur is volatilised in a stream of gas in which it cannot take fire, and that in consequence the gold is not dissipated. Be this as it may, I am sure that this method in skilful hands will show amounts of gold in many iron pyrites, far beyond the belief of most of the assayers who have examined them in the ordinary way.—I am, &c.,

J. M. MERRICK

Laboratory, 59, Broad Street, Boston, U.S.A.,
August 24, 1872.

MISCELLANEOUS.

Spontaneous Generation of Doctors.—The following letter appears in the *Lancet* for August 17:—

"Spontaneous Generation of Doctors.

"*To the Editor of the Lancet.*

"Sir,—Your able remarks on foreign degrees induce me to request of you a small space to notice the remarkable creation of doctors that has been going on for some time past in the columns of your weekly contemporary, the Chemical News. Almost every foreign name in that journal for the last year or two has the prefix of 'Dr.;' and as many of these German and French gentlemen are personally known to me, I can assure you they would be more surprised than pleased if they saw themselves thus decorated by an unknown hand. British subjects, for palpable reasons, are not so honoured. It is clear that the editor is jealous of doctors generally; and in thus creating an abundant and fictitious flock of foreign doctors, he intends, no doubt, to throw a slur upon the titles obtained at foreign Universities by many of your most distinguished professors, and more especially your distinguished chemists. Pray allow me to expose this practice in the columns of your widely-read journal, and believe me, Sir,

"Your constant reader and obedient servant,

"L. Stein, M.D.,

"Demonstrator of Anatomy in the University of Copenhagen.

"Brighton, Aug. 14, 1872."

It is amusing to find that while L. Stein, *M.D.*, sends this letter to the medical papers, a Th. Kindt, *Ph.D.*, has been sending the same letter to scientific journals (both emanating from Brighton). One gentleman, after reading the letter, took the precaution to look through twenty-six numbers of the Chemical News, and out of 883 names of foreign authors he found only 178 having the prefix of "Dr." We would suggest that the Editor of the *Lancet* should have taken some such precaution, and thus have avoided the publication of untruths. In all cases in which we have given the author of a printed paper the title of "Dr.," the title has been copied from the foreign periodical containing the original article. As, however, the *Lancet* is the only journal which has thought fit to pay attention to the dishonourable insinuations levelled against the Editor of the Chemical News, and as Mr. Stein is evidently anxious that his remarks should be read by the greatest possible number of scientific men, we have had much pleasure in gratifying him by reprinting his letter with its very sensational heading.

The Royal Polytechnic.—An interesting Lecture on "Coal and How to Save it" is now being delivered at this Institution, by Professor E. V. Gardner. In the course of the Lecture mention is made of Stone's Patent for coating steam boilers. This coating is said to effect an economy of one-third in the employment of coal for driving machinery. The Laboratory of the Chemical Department has been reorganised and newly fitted, and is now opened under the direction of Professor Gardner.

Refractory Clays.—Bischof finds that the analysis of a clay gives a distinct indication as to its power of resisting extreme heats. The temperatures were measured by keeping the clay at a white heat till wires of iron or platinum were fused. The value of a refractory clay is found by the proportion of the alumina to the fusible matter, and again by that of the alumina to the silica. The more alumina a clay contains in proportion to the fusible matter (iron, alkalies, &c.), the more refractory is it. Silica, on the contrary, augments its fusibility. Of two clays containing alumina and fusible matter in the same proportions, that which contains least silica is most refractory. Save in certain determinate cases, the clays containing alumina, silica, and fusible matter in equal proportions have an equal power of resisting fire. If we give to clays the general formula, $mAl_2O_3+nSiO_2+RO$, the degree of resistance to fire is measured by $\frac{m}{n}$. The higher the value of this fraction, the more refractory the clay.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, September 2, 1872.

This number opens with excellent speeches from the President, Dr. Faye, and one of the Perpetual Secretaries, Dr. J. Dumas, on the occasion of the presentation of a medal to Professor Chevreul (born August 31, 1786) in consideration of his eminent services to science, industry, arts, and the Academy, during a period of more than sixty years. The eminent speakers give a vivid account of the long and laborious career of the illustrious *savant*, the *doyen* of the Chemical Section of the Academy.

This number contains the following original papers and memoirs relating to chemistry:—

New Method of Extracting the Precious Metals from Copper-Containing Pyrites.—F. Claudet.—The spent or burnt pyrites (Spanish and Portuguese) contains, according to the author, from 0·0020 to 0·0028 per cent of silver (equal to from 20 to 28 grms. to the ton), and, in addition, a small quantity of gold; the extraction of these small quantities might at first sight appear futile, but, as the quantity of pyrites burnt in the United Kingdom alone amounts annually to between 400,000 and 500,000 tons, the extraction of the precious metals therefrom is of importance. The author describes at length a method of operation which is now successfully used in a factory established by him and Mr. J. Phillips at Widnes, near Liverpool; the process is based upon the insolubility of iodide of silver in a solution of chloride of sodium at the ordinary temperature. The burnt pyrites is first ground to powder, sifted, and next gently ignited with some common salt: the ignited mass is, after cooling, treated with dilute hydrochloric acid, and a sufficient quantity of iodide of potassium is added to the clear liquor. In the dry state, the precipitate formed consists, in 100 parts, of—Silver, 5·95; gold, 0·06; lead, 62·28: copper, 0·60; oxide of zinc, 15·46; oxide of iron, 1·50; lime, 1·10; insoluble residue. 1·75; loss and oxygen, 3·62. In the year 1871, at the works above mentioned, 16,300 tons of spent pyrites were operated upon, yielding 333·242 kilos. of silver and 3·172 kilos. of gold, the net value of which, after deducting expense of refining and the loss of 137 kilos. of iodine, was £3230.

Division of One Base between Several Acids when in Solution; Bibasic Acids.—Dr. Berthelot.—The continuation and end of this lengthy essay.

Spontaneous Combustion of a Wooden Beam by the Sole Action of the Solar Rays.—M. Collet.—This short paper contains the account of the spontaneous combustion of a wooden beam in a building at Ribemont (Aisne). The oak beam was found to be on fire during one of the hot days in the summer; it was directly exposed in an open yard to the concentrated heat of the sun's rays; the combustion, although proceeding slowly, was quite distinct, but was not attended with flame; the smoke, however, had a peculiar appearance, and on blowing the wood it burst into flame. The author asserts that the fire was entirely due to the heat of the sun.

September 9, 1872.

This number contains, in addition to several original papers and memoirs relating to botany, meteorology, astronomy, natural philosophy, mathematics, and mechanics, the following original papers bearing upon chemistry:—

Result of the Action of the Sun's Rays upon Various Kinds of Glass.—T. Gaffield.—This paper, to which is added a lengthy appendix by Chevreul, records the results of a series of experiments, continued for several years, on the effect of the sun's rays, and the molecular alterations produced in various kinds of glass by being exposed to these rays for a considerable length of time and under different conditions.

Induction Currents Developed in Gramme's Electric Machine.—J. M. Gaugain.

New Kind of Urinary Concretion Found in Horned Cattle.—G. Roster.—This paper treats on a peculiar urinary deposit first observed by an Italian veterinary surgeon at Pietra-Santa. The crystalline matter is insoluble in alcohol and ether, and yields ammonia when ignited with soda-lime. It smoulders away without flame when heated upon platinum foil over a spirit-lamp flame, leaving a white, porous, very light ash, soluble in water, but not rendering it alkaline, and found to be magnesia; the composition of this material was ascertained to be $C_{30}H_{36}N_2MgO_{18}$, that is, lithurate of magnesia. The free lithuric acid is a solid crystalline body, fusing at 205°, soluble in boiling-hot water and boiling alcohol, but insoluble in ether.

Annalen der Physik und Chemie, von Dr. J. C. Poggendorff, No. 8, 1872.

This number contains the following original papers and memoirs more particularly relating to chemistry:—

Method of Measurement of the Velocity of Rotating Mechanisms.—A. Schuller.

Researches on Fluorescens.—E. Hagenbach.—The continuation and conclusion of this monograph.

Glacial Formation of the Fjords and Alpine Ice Seas of Norway.—A. Helland.

Remarkable Block of Lava Hurled Upwards by the Late Eruption of Vesuvius.—G. vom Rath.—This memoir treats on the mode of formation and mineralogical characters of a solid piece of lava lately thrown up by the eruption of the volcano.

Researches on the Spectrum of the Aurora Borealis.—H. C. Vogel.

Relation Existing between the Second Axioma of the Mechanical Theory of Heat and the Hamilton Principle.—R. Clausius.

Contribution to our Knowledge on the Thallium Compounds.—C. Rammelsberg.—This exhaustive monograph treats at length on the following compounds:—Hyposulphate of thallium, $Tl_2S_2O_6$: equiv. = 568; percentical composition—Tl, 71·83; S, 11·27; O, 16·90. Iodate, $TlIO_3$; equiv. = 379; in 100 parts—Tl, 53·82; I, 33·51; O, 12·67. Di-iodate of thallium (iodate of sesquioxide)—

$$TlI_6O_{18}+3aq=(TlO_3+3I_2O_5)+3aq.$$

Thallium periodate does not exist; with periodic acid, thallium behaves like iron, manganese, and cobalt, all of which become oxidised to a higher degree, while iodic acid is simultaneously formed. Dithallium periodate. Thallium sesquichloride, Tl_2C_3; equiv. = 514·5; in 100 parts—Tl, 79·3; Cl, 20·7. Dithallium-potassium chloride. Ammonium-dithallium chloride. Potassium-dithallium bromide. Potassium-dithallium iodide. Isomorphism of the thallium salts with that of the salts of monoatomic metals. Perchlorates. Phosphates. Sulphates, seleniates, and chromates. Double sulphates of the magnesian group. Thallium alum, $Tl_2RS_4O_{16}+24aq$. Carbonate, Tl_2CO_3. Oxalates. Tartrates. Paratartrates. Picrates. Cyanides.

Description of an Instrument Contrived for the Purpose of Measuring the Thickness of any Substance.—P. Schönemann.—Illustrated by engravings.

New Shape of the Noë Thermo-Electric Element.—Dr. A. von Waltenhofen.

Pressure and Elastic Shock (Elastischer Stoss).—G. Hansemann.

Annales de Chimie et de Physique, September, 1872.

This number contains the following original papers and memoirs:—

Atmospheric Ozone.—A. Houzeau.—This monograph, elucidated by a large number of tabulated forms, is divided into the following sections:—Historical notices; oxidising power of normal air; smell of normal air; decolourising and disinfectant properties of normal air; meteorological portion; mode of application of semi-iodurated paper; proportion of ozone contained in air; observations made at Ecorchebœuf in 1863; manifestation of ozone according to the seasons; influence of storms and hurricanes upon the manifestation of ozone; origin of atmospheric ozone.

Researches on Dulcite and on Sugars in General.—Dr. G. Bouchardat.—This memoir, the first instalment of an exhaustive essay on this subject, has been already alluded to from the abstracts published by the author in other periodicals; the full account of every experiment and method of research is here published.

New Process for the Volumetrical Estimation of Copper and of Sugar.—F. Weil.—Reserved for translation.

Synthesis of Orcin, and on some of the Sulphuretted Derivatives of Toluen.—G. Vogt and A. Henninger.—Notwithstanding the high scientific value of this essay, its contents are not well suited for any useful abstraction.

Polytechnisches Journal von Dr. E. M. Dingler, first number for August, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Newly-Contrived Water Air-Pump.—C. Christiansen.—The description, illustrated by a woodcut, of a readily-constructed piece of apparatus for use instead of the Bunsen air-pump.

Bunsen Dip (Tauch) Battery.—J. Müller.—This essay is illustrated by a series of engravings.

Validity of the Patent of the Hoffmann Ring Furnace Viewed According to Facts.—Dr. H. Seger.—This memoir, illustrated by several engravings, treats on the legal validity of a German patent. It appears that the invention is an immense improvement in the mode of constructing brick-, lime-, and other kilns.

Composition of the Lyes Obtained by Lixiviation and Oxidation of the Soda Waste for the Purpose of Obtaining Sulphur therefrom.—C. Stahlschmidt.—This exhaustive essay is divided into the following sections:—Introduction; this treats, in the first place, on the process of recovering sulphur from soda waste; it also contains a concise review of the different modes of operation proposed and carried out, and a discussion on the nature and composition of soda waste. Estimation of sulphurous, hyposulphurous, and sulphuric acids. Behaviour of the sulphur lye with sulphurous acid. The author observes that he is not enabled to give precise directions for practical use, in consequence of the variation in the composition of the lyes.

Studies for Establishing a Scientifically-Arranged Tanning Method.—A. Reimer.—The continuation of this monograph; this part of the author's memoir contains the following sections:—Skin (corium) and water; skin and lime and other alkaline matter; skin and acids; skin and tannic acid; skin and chloride of sodium.

Boracic Acid as a Preservative for Milk and Beer.—A. Hirschberg.—It appears that there has been for sale for some time in Sweden, under the name of aseptin, a mixture consisting of equal parts of boracic acid and alum, this mixture being applied for the preservation of meat, and also for protecting it from the injurious action of the oak-wood of the casks in which it is kept. The author states that he found that, by adding 1 grm. of boracic acid to 2 pounds of milk, it remained sweet and fresh in hot summer weather for 120 hours, while milk not so treated became sour and quite useless in 36 hours; the addition of boracic acid to milk does not interfere with its use, but the cream is separated far more slowly. Experiments have shown that beer is improved by the addition of boracic acid, even if it is kept at a comparatively high temperature.

Protection of Wood from Fire.—F. Sieburger.—After first referring to the inconveniences of the application of chloride of zinc and so-called water-glass solution, the author says that it is preferable to first coat or wash the wood twice with a hot and saturated solution of 3 parts of alum and 1 part of sulphate of iron, and next with a more dilute solution of sulphate of iron, to which sufficient pipe-clay has been added to render it as thick as ordinary oil paint. Another method is the following:—The wood is repeatedly painted over with a hot solution of glue, until a very thin coat of glue remains on the surface; then the wood is painted over with a thicker solution of glue, and a mixture of 1 part of sulphur, 1 part of ochre or pipe-clay, and 6 parts of sulphate of iron, is applied to the wood with a dredger, the ingredients having been first separately pulverised and thoroughly mixed.

Le Moniteur Scientifique Quesneville, No. 369, September, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Revue des Inventions Nouvelles.—A. Jouglet.—This memoir contains the concise description of a series of some thirty new inventions relating to various branches of industry; those of the inventions which relate to chemical science have been already described in our pages. The author, while briefly alluding to Hemptinne's process for concentrating sulphuric acid in vacuum pans, promises to publish shortly a full account of this invention with its latest improvements.

Manufacture of Ultramarine by One Single Calcination.—M. Fürstenau.—This process is based upon the fact that, when an aluminous white ultramarine is first moistened with a solution of resin in sulphide of carbon, and then ignited over a spirit-lamp in a porcelain crucible, blue ultramarine of great beauty is formed. The mixture to be calcined should contain the elements of pentasulphide of carbon, while the temperature of ignition should be as low as possible. The composition of the mixture to be used on the large scale (woodcuts exhibit the arrangement of the furnace and crucibles) varies somewhat, but the following will, however, give an idea of the composition of the mixture:—Kaolin, previously lightly ignited, and free from undecomposed felspar, 100; soda, 90; sulphur, 110; resin, 10; finely-divided charcoal, 10. The mode of manipulation is described at length, but it appears that the process is attended with technical difficulties, and requires careful workmen to execute it satisfactorily.

Coralline and its Use in Dyeing and Printing.—Dr. Quesneville.—This paper contains an account of the history of invention, present method of preparation, and method of application to cotton and silk fabrics.

Coralline Printing on Woollen Fabrics.—Dr. Kielmeyer.—The detailed description, with receipts for the practical application of printing with coralline on flannels and similar woollen fabrics; the process described is also applicable, with a slight modification of ingredients, for printing coralline on cotton fabrics.

Preservation of Timber.—R. H. Buell, C.E.—This memoir, too lengthy for any useful abstraction, contains an excellent review of all that is known concerning the decay of timber and the causes thereof, as well as a full account of the various processes proposed and tried for its preservation.

New Process of Brewing Beer.—A. Jouglet.—The author describes at length, and illustrates with woodcuts, Pasteur's *brevet* for improvements in brewing, which will undoubtedly tend to make that

process more simple, easier to control, and produce a better yield of beer, both as regards quality and quantity.

Researches on the Part which Sulphurous Acid Plays when Employed to Produce the Saccharification and Alcoholisation (Alcoolisation) of Grain, According to a New Method.—V. Hemilian and N. Melnikoff.—Reserved for full translation.

Researches on Chondrine.—Dr. J. Moleschott and A. Rubini.—After referring to the tests given by the late Berzelius and by Dr. G. J. Mulder for albumenoid and gelatinous substances, the authors point out that the precipitate formed in a clear solution of chondrine by acetic acid (albumenoid solutions acidulated with that acid are precipitated by solution of ferrocyanide of potassium, while gelatinous substances are not, under the same conditions, precipitated), is re-dissolved by the addition of solution of ferrocyanide of potassium; an excess of acetic acid re-dissolves, especially when a gentle heat or boiling temperature is applied, the precipitate first formed by that acid in a clear solution of chondrine. Tartaric acid is preferable to acetic acid for the chondrine reactions.

Gazzetta Chimica Italiana, No. 6, 1872.

This number contains the Faraday lecture, delivered by Dr. S. Cannizzaro, a report of which has already appeared in our pages.

Researches on Trichlorurated Acetal and on Tetrachlorurated Ether.—Drs. E. Paterno and G. Pisati.—After first referring to the labours of A. Wurtz and G. Vogt on this subject, the authors state that they commenced their researches by preparing, according to L. Henry's method, a larger quantity of tetrachlorurated ether. The boiling-point of that body is 189·7°; its density, referred to that of water at 4°, is at 0° 1·4379. When this ether is poured into a glass tube with alcohol, and the tube next sealed and heated in a bath of saturated brine, the result is the formation of Wurtz's and Vogt's trichlorurated acetal, a mobile transparent liquid of an agreeable odour, boiling at 204·8°; its sp. gr. at 0° is 1·2813; its formula is—

$$C_2Cl_3H(C_2H_5O)_2;$$

percentical composition, in 100 parts—Carbon, 32·52; hydrogen, 4·96; chlorine, 48·05; oxygen, 14·47. This essay further treats on the researches of the first-named author on trichlorurated acetal, as obtained some time ago as a by-product of the preparation of bichlor-acetal by the action of chlorine upon alcohol, the results of which experiments have been published in the *Giornale di Scienze Nat. ed Econ.*, vol. iv., 1867, and on the action of alkaline alcoholic solutions upon tetrachlorurated ether in sealed tubes exposed to a higher temperature, yielding, after purification and fractional distillation, a fluid boiling at 154·8°, having a sp. gr. at 0° of 1·3725, and consisting, in 100 parts, of—Carbon, 27·37; hydrogen, 2·85; chlorine, 60·65. This compound combines with bromine, and forms a body of which the formula is stated to be, in all probability, $CCl_2Br-CClBr.O.C_2H_5$.

Researches on the Detection of Bromine in the Presence of Urea.—Prof. G. Bizio.—This excellent essay is an addition to the author's monograph, published in 1865 (*Atti del Reale Instituto Veneto delle Scienze*), "On the Influence of Urine as Modifying certain Chemical Reactions." Notwithstanding the high scientific value of this memoir, its contents are not well suited for abstraction.

La Revue Scientifique de la France et de l'Etranger, September 14, 1872.

This number contains no original papers relating to chemistry, but is entirely devoted to the record of the proceedings of the opening of the first meeting of the French Association for the Advancement of Science. We find here *in extenso*—(1) The speech of the President, M. de Quatrefages, on "Science and Fatherland (Patrie). (2) An excellent extempore speech by M. Fourcand, the Maire of the ancient and beautiful city of Bordeaux. (3) "History of the Origin of the Association," by M. Cornu. (4) "Report on the Financial Condition," by G. Masson. (5) The reproduction of the telegram sent from Moscow, by the Russian naturalists assembled in the ancient City of the Czars for the purpose of celebrating the bicentenary of Peter the Great's birth, and remembering his merits in reference to science and civilisation in Russia, to the members of the Association at Bordeaux; from this telegram we quote the following:—Le degré élevé que les sciences ont atteint en France est la plus belle conquête de l'humanité; puisse-t-elle prospérer et continuer au bien être général et aux liens internationaux, scientifiques humanitaires." From the reply telegram sent from Bordeaux we quote the following:—"Elle (L'Association) vous remercie donc au nom de la science que nous aimons tous et que nous voulons servir chacun dans sa sphère, chacun dans son pays, car c'est une œuvre de civilisation générale que nous poursuivons avec vous." This number also contains reports of the labours of some of the section meetings, and two lectures relating to military matters given in the general *séances*. Several *savants* from foreign countries attend the meeting.

American Journal of Pharmacy, September, 1872.

This number contains no original papers relating to chemistry or collateral subjects.

The American Journal of Science and Arts, August, 1872.

In addition to several important papers relating to geology, mineralogy, engineering, and natural history, this number contains the following paper relating to chemistry:—

Estimation of Sulphur in Coal and in Organic Compounds.—W. G. Mixter.—The author's process is based upon the combustion of the substances in oxygen, while the sulphur is condensed from the gaseous products in the form of sulphuric acid. The method of operating is fully detailed, and, from the results of experiments, it appears that this mode of determining sulphur in coal and organic compounds is more correct and expeditious than those now in use; the quantity of material operated upon may also be considerably less. Without the reproduction of the woodcut with which this paper is illustrated, the description of the apparatus is impossible.

Bulletin de la Société Chimique de Paris, August 1, 1872.

Syntheis of Parabanic Acid.—M. Ponomareff.—Urea is, according to the author, converted into parabanic acid by the action of that acid and of terchloride of phosphorus, while heat is set free, and hydrochloric acid is developed; the parabanic acid thus obtained is insoluble in alcohol. The aqueous solution yields with ntirate of silver an insoluble precipitate, readily soluble in excess of nitric acid; the formula of this silver salt is $C_3Ag_2N_2O_3$, and the formula of the free parabanic acid is $C_3H_2N_2O_3.2H_2O$ or $C_3H_2N_2O_3.H_2O$.

New Quinine Trical Process.—P. Carles.—Reserved for translation.

Memoir on Phosphoplatinic Compounds.—P. Schützenberger and E. Fontaine.—The continuation of an exhaustive monograph on this subject; it contains lengthy and complex formulæ.

On Camphic Acid.—J. de Montgolfier.—The contents of this paper relate to the rectification of some errors made by Kachler as regards camphic and campholic acids. The author states that Kachler's assertion, that camphic acid is only a mixture of campholic acid and an acid resin, is not correct, and, further, refers to Berthelot's researches on this subject, published in various scientific periodicals. Lastly, reference is made to camphoronic acid, $C_{18}H_{12}O_{10}$, which can be obtained by saturating with ammonia the mother-liquor obtained in the preparation of camphoric acid.

Combinations of Dulcite and Benzoic Acid.—G. Bouchardat.—This essay treats on hexabenzoic dulcite, $C_{12}H_2(C_{14}H_6O_4)_6$, a solid crystalline body, fusing at 147°, sublimable with partial decomposition at 220°, perfectly insoluble in water and in ether, and difficultly soluble in boiling alcohol; when hexabenzoic dulcite is suddenly heated to 200°, and then cooled, it becomes an amorphous mass, entirely soluble in ether; it soon, however, crystallises. Tetrabenzoic dulcitan—

$$C_{12}H_8(H_2O_5)(C_{14}H_6O_4)_4,$$

is also a solid resin-like body, insoluble in water, and nearly so in alcohol; this substance is sublimable without decomposition, and fuses at 150°.

Archives Néerlandaises des Sciences Exactes et Naturelles, Vol. vii., No. 1, 1872.

In addition to purely mathematical and algebraical papers, this number contains the following original memoirs relating to chemistry and collateral subjects:—

Action of Light upon Chlorophyll.—E. Gerland.—This exhaustive essay treats on the combined effect of light and oxygen upon chlorophyll. Among the conclusions drawn by the author we quote the following:—In the presence of air and light the molecules of chlorophyll are submitted to the action of two forces, which tend to alter them, viz., the chemical action of oxygen and the action of light; but, in order to affect any alteration, the joint action of the two is required, as in the dark, unless oxygen is also present, no alteration of the chlorophyll takes place. When a solution of chlorophyll is exposed to the action of air and light, the oxygen combines with the pigment, which thus becomes modified; and when the intensity of the light is sufficiently strong, this action of the oxygen is interrupted, and decolouration of the chlorophyll ensues. If, however, the intensity of the light is weak, the oxidation proceeds, and the pigment is entirely converted into modified chlorophyll. A large portion of this essay is devoted to spectroscopical researches on chlorophyll.

Crystallites, and Crystallogenic Studies.—H. Vogelsang.—This is the continuation of a monograph on this subject, illustrated by engravings exhibiting crystalline substances seen by the microscope.

Agronomic Systems of the Netherlands.—W. C. H. Staring.—This memoir contains information on the rotation of crops, and on the extent of cultivated and uncultivated land, including lakes, marsh ground, and moors, in the Netherlands, and on the divers systems of agriculture. Nearly one-fifth of the entire surface of the kingdom is entirely unfit for cultivation, while more than another one-fifth is meadow land; 28,600 hectares are market gardener's land; 20,000 hectares are orchards; 19,000 are cultivated with tobacco; 14,000 with hemp; 150 with hops (only in one district); and 200 hectares are specially devoted to the cultivation of bulbs of tulips, hyacinths, &c. The total surface of the kingdom is here stated to be 3,289,000 hectares.

Les Mondes, September 5 and 12, 1872.

These numbers contain no original matter or communications relating to chemistry and collateral subjects.

Revue Universelle des Mines, de la Metallurgie, des Travaux Publics, des Sciences et des Arts Appliqués à l'Industrie, May, 1872.

This number contains no original papers relating to chemistry.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2454. W. Ferrie, Airdrie, Lanarkshire. N.B., "Improvements in connection with furnaces for smelting iron."—Petition recorded August 17, 1872.

2491. C. F. Sebille, Paris, France, "Improvements in the composition known as 'schisto-asphaltic and bituminous beton' and novel applications thereof, together with improved machinery or apparatus in connection therewith."

2497. J. R. Roper and A. Alexander, Sheffield, Yorkshire, "Improvements in the treatment of iron and manufacture of steel."—Petitions recorded August 22, 1872.

2515. R. Goodall, Armley, Leeds, Yorkshire, "An improved means or method of, and apparatus for, clarifying impure or waste water from fulling mills, scouring mills or scouring processes, dye-houses, sewage, and other impure waters."—Petition recorded August 24, 1872.

2527. C. Frickinger, Berlin, Prussia, "Improvements in the manufacture of malleable iron and in the furnaces employed therein."

2529. H. A. Duférré, Paris, France, "An improved mode of preserving fruit."—A communication from F. Sacc, Neuchatel, Switzerland.—Petitions recorded August 26, 1872.

2545. C. Morfit, Baltimore, Ma., U.S.A., "Improvements in vats or vessels for the various chemical and manufacturing operations which involve the use of acids."—Petition recorded August 27, 1872.

INVENTION PROTECTED BY THE DEPOSIT OF COMPLETE SPECIFICATION.

2572. W. R. Lake, Southampton Buildings, London, 'Improved compounds, chiefly designed for coating ships' bottoms."—A communication from J. H. Bloodgood, New York, U.S.A.—Petition recorded August 29, 1872.

NOTICES TO PROCE D.

2035. B. Todd, Newcastle-upon-Tyne, "Improvements in the treatment of gases and fumes."—Petition recorded July 5, 1872.

2417. F. D. Blyth, Fenchurch Street, London, and A. G. Southby, New Inn, Middlesex, "Improvements in the process and apparatus for heating wood for the manufacture of pulp for paper."—Petition recorded August 14, 1872.

2431. T. Routledge, Ford Works, near Sunderland, "Improvements in treating fibrous substances for textile purposes, and for the manufacture of paper stock."

2443. W. R. Lake, Southampton Buildings, London, "Improvements in puddling furnaces."—A communication from G. E. Harding, New York, U.S.A.—Petitions recorded August 15, 1872.

PATENTS SEALED.

705. A. F. Andrews, New Haven, Conn., U.S.A., "Improvements in the process of making malleable cast-iron and in apparatus therefor."

715. J. Garneri, Gracechurch Street, London, "A new system or process for the production and decomposition of anhydrous chlorides, and apparatus for those purposes.—Dated March 8, 1872.

958. C. D. Abel, Southampton Buildings, Middlesex, "An improved process for the preparation of acid phosphate or superphosphate of lime."—A communication from G. Ville, Paris, France.—Dated April 1, 1872.

1509. J. A. Froitzheim, Cologne, Prussia, "Improved manufacture of explosive compounds."—Dated May 17, 1872.

1951. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in preserving butter and other fatty matters, and in the apparatus or means employed therein."—A communication from Enault and Company, Paris, France.—Dated June 28, 1872.

2029. B. J. B. Mills, Southampton Buildings, London, "Improvements in sizing paper, paper pulp, cotton, linen, and other fabrics and materials, and in materials to be employed therefor."—A communication from J. MacDorlan, East Brandywine, Penn., U.S.A.—Dated July 4, 1872.

2119. W. R. Lake, Southampton Buildings, London, "An improved gypsum cement."—A communication from E. F. A. Schott, Seesen, Germany.—Dated July 13, 1872.

FOREIGN PATENTS.

UNITED STATES OF AMERICA.

128978. A. E. Reed, "Manufacture of paper."
128992. S. Wheeler, "Manufacture of paper."
128993. J. Wilson, "Furnace for reducing iron ores."
129014. A. Farrar, "Process of refining oil from the acid residuum of oil works."
129044. J. Matthews, "Manufacture of mineral waters."
129114. F. C. Durant, "Treating sugar."
129151. J. D. Marshbank, "Cupola furnace for melting iron."
129153. H. McDonald, "Puddling furnace."
129185. A. T. Sturdevant, "Manufacture of paper stock."
129199. R. G. Wood and J. R. Jackson, "Furnace for the mechanical puddling of iron."
129204. W. Archdeacon, "Preparing wooden vessels for holding acids."
129217. A. K. Eaton, "Compound of gelatine, tannin, and cellulose."
129243. J. W. Middleton, "Process and apparatus for the manufacture of iron and steel."
129261. G. Whitney, "Metal for castings."
129284. J. Kintz, "Process of colouring tin, zinc, &c., so as to resemble gilding."
129310. P. Bearsch, "Hair restorative."
129341. B. R. Hawley, "Bleaching cane-juice and other liquids with sulphurous acid."
129342. A. Haws, "Medical compound for small-pox."
129343. A. Haws, "Medical compound for cholera infantum, &c."
129417. D. McDaniel, W. B. Spear, and J. W. Richards, "Method of utilising waste tin scrap and galvanised iron."
129430. W. Sellers, "Puddling iron."
129438. C. Toppan, "Process of treating articles to render them waterproof."
129463. S. H. Crocker, "Purification of paraffine."
129469. N. W. Gaddy, "Medical compound for healing wounds, &c."
129503. P. Welch, "Preserving wood."
129517. E. P. Baugh and D. Baugh, "Treatment of horns, hoofs, and other organic matter."
129525. W. T. Bush, "Manufacture of soap for shaving, toilet, &c."
129608. J. N. Smith, "Hair restorative."
129626. H. A. Tilden, "Medical compound."
129645. E. B. Benedict, "Calcinine."
129689. J. W. Snyder, "Manufacture of artificial stone."
129708. M. C. Bland, "Compound for polishing metals, glass, &c.
129720. C. F. Dieterich and A. Schüssler, "Manufacture of illuminating gas."
129732. C. Hefft, "Compound for clarifying beer and other liquids."
129739. D. I. Loewenstein, "Manufacture of fertilisers from night soil."
129753. L. Scala, "Dyeing with indigo."
129762. J. A. Stearus, "Puddling furnace."
129815. L. S. Goodrich, "Process and apparatus for the manufacture of charcoal."
129835. M. H. Kollock, "Preparing wheat for food."
129841. G. Little, "Preparing paper for automatic telegraphy and in recovering chemicals from waste-paper."
129886. W. W. Gardner, "Medical compound for cure of colic, &c."
129899. J. W. Middleton, "Apparatus for producing refined iron and steel castings."
129901. E. Osgood, "Process of rendering leather, fibrous and porous materials impervious to gas."
129937. T. P. Devor. "Cider bitters."
129942. E. Gauvreau, "Medical compound or cough lozenge."
129951. G. W. Harris and H. P. Allen, "Manufacture of illuminating gas."
129997. W. T. Walker, "Apparatus for purifying gas."
130001. O. Zaretusch, "Apparatus for generating carbonic acid gas."
130004. J. D. Averell, "Carburetter."
130044. G. E. Harding, "Puddling furnace."
130091. J. R. Weed, "Article of food."
130114. J. Dupont, "Treating plants to produce paper-pulp and fibre."
130123. C. F. Fuchs and A. Clement, "Gun and blasting powder."
130160. G. Smith, "Hair restorer and colouring compound."
130164. G. Symes, "Apparatus for the manufacture of gas."
130174. J. Young, "Process and apparatus for the manufacture of carbonate of soda."
130200. Z. S. Durfee, "Metallurgic furnace."
130229. A. MacDougall, "Medical compound or ointment for horses' hoofs."
130230. H. MacDougall and C. MacDougall, "Manufacture of glue."
130241. H. A. V. Post, "Apparatus for puddling and melting iron."
130245. J. S. Rosenthal, "Treatment of asbestos for the production of textile fibres.
130263. E. Wilson, "Medical compound or salve."
130277. J. W. Burton, "Treating and refining oils and fats.
130279. J. G. Colcord, "Composition for coating marine cloths."
130282. J. Damken, "Manufacture of condensed wine."
130298. E. N. Horsford, "Manufacture of phosphate of lime and yeast powders."

SAXONY.

3125. E. T. Payen and H. Roux, "A new method of extracting metals, except iron, from their ores."—Dated May 28, 1872.

3144. A. Grell, "Manufacturing stearine and oleine."—Dated June 7, 1872.

TO CORRESPONDENTS.

A. M. Edwards, Newark, N.J.—We will bear it in mind.

H. Townsend.—The work will not be completed for some time to come.

Prof. R. V. Tuson.—Unfortunately your communication did not arrive until we had gone to press.

W. F. D.—We are sorry we did not receive the information earlier. An advertisement would be beneficial.

H. B. Yardley.—As far as we know no such table is published, but it is easy to calculate from the tables of specific gravity of acids.

Sydney Gibbons, Melbourne.—Received with thanks.

Dr. J. Emerson Reynolds.—We are obliged for your communication.

THE CHEMICAL NEWS.

VOL. XXVI. No. 670.

THE ALLEGED CONVERSION OF ALKALINE SULPHATES INTO CHLORIDES BY IGNITION WITH AMMONIUM CHLORIDE.

By EDWARD NICHOLSON, F.C.S.,
Assistant Surgeon, Royal Artillery; Analyst of Waters, Madras Presidency.

AN error, occurring originally in Fresenius, and copied from it into other analytical handbooks, has come to my notice in a rather peculiar manner. A new scheme (the third) for the analysis of potable waters has lately been inflicted, by authority, on India; and in a local medical journal I criticised it rather severely, though not more so than it deserved, as it is a mere patchwork of processes, many of them good, but picked out of books and put together with little evidence of either practical chemical knowledge or of Indian experience. One of the processes I criticised was the following; it occurs in the process for the determination of alkalies:—

"Add some chloride of ammonium (to convert sulphate of sodium or potassium into the chloride), evaporate, ignite, and weigh the residual chloride of sodium and potassium. If the water contain only a small proportion of sulphuric acid, the addition of the chloride of ammonium will suffice for the conversion of the sulphates into chlorides; but if the proportion of sulphuric acid is large, it is necessary to add at once, before the addition of the milk of lime, a quantity of chloride of barium equivalent to the known amount of the sulphuric acid."

I pointed out that the reaction indicated was an impossible one, and that there was not the slightest ground, *in fact*, for the assertion that sulphuric acid could be thus expelled.

Rejoinders followed, more remarkable for faith in textbooks than for evidence of profit by their teachings; it was pointed out that the process, being copied from Fresenius, must be quite correct. One anonymous representative of Indian professorial chemistry declared that he would rather "go to hell with Fresenius than to heaven with Mr. Nicholson." The author of the scheme declared, more politely, but no less strongly, that he and the authorities were right; he regretted the consequences which my temerity will bring down on me. An apothecary, who is officiating as assistant to the Madras Professor of Chemistry, alone had the happy thought to try the experiment; and he proved most satisfactorily to himself that Fresenius is right, provided that not more than 1 milligramme of alkaline sulphate is operated on; beyond that quantity the spell refuses to work, and the conversion is incomplete.

In consequence of this little episode, I proceeded to examine how far it is possible for ammonium chloride to effect any permanent change in alkaline sulphates.

The following experiments were made with salts of ascertained purity. In each case the mixture was dissolved in a little water, and the solution evaporated down on the water-bath. The ignition was made as rapidly as could be without incurring danger of decrepitation.

(1). 0·0967 grm. of sodium sulphate, ignited with 0·2330 grm. of ammonium chloride. Weight of residue unaffected to within 0·0001 grm. Dissolved in 5 c.c. of water, it gave less than 0·0002 grm. of chlorine. Formation of sodium chloride equal to about 3 parts in 1000.

(2). 0·022 grm. of sodium sulphate ignited twice, each time with 0·010 grm. of ammonium chloride. The residue, dissolved in 2 c.c. of water in 1 c.c. of the amount of sulphate had undergone no perceptible alteration; in the other, silver nitrate produced a slight opalescence, estimated to be equal to that produced in 1 c.c. of a water containing 0·03 grm. per litre of sodium chloride. As nearly as could be estimated on such a minute quantity, the amount of chloride formed amounted to 30 parts per 1000.

(3). 0·010 grm. of sodium sulphate ignited twice; the first time with 0·065 grm., the second time with 0·130 grm. of ammonium chloride. The residue gave 0·0001 grm. of sodium chloride. Conversion equal to 10 parts per 1000.

(4). 0·0324 grm. of sodium sulphate, ignited with 0·0500 grm. of sodium chloride and 0·0840 grm. of ammonium chloride. This experiment would correspond to that performed in the treatment of a litre of ordinary potable water. The loss of weight after ignition was 0·0010 grm.; but this was rather uncertain, owing to the difficulty in weighing sodium chloride accurately in the very damp climate where the experiment was made. Sulphuric acid was determined in the residue, also in 0·0324 grm. of the original sodium sulphate. The results were—

	$BaSO_4$.	SO_4.
Original salt	0·0539 grm.	= 0·0222 grm.
Residue of ignition	0·0537 ,,	= 0·0221 ,,
Theory	—	= 0·0219 grm.

I think these experiments show that, even with very small quantities, there is practically no change effected in the process under discussion. The very partial reaction that does take place is of no use in analysis; the process is an ineffectual attempt at forcible reversion of the ordinary reaction, by bringing a large excess of ammonium chloride to bear on the sulphate. Evaporation and ignition with ammonium chloride only affect the nitrates, carbonates, and silicates present in water, but ammonium sulphate converts all chlorides, nitrates, &c., into sulphates; in fact, sulphuric acid acts just as effectually when guarded* with ammonia as when free. I am rather surprised at seeing this erroneous statement persistent in successive editions of Fresenius.

I intend to investigate the statical points connected with the reaction of ammoniacal salts on alkaline sulphates and chlorides; in the meantime, I think it advisable to draw attention to the error occurring in the handbooks of analysis.

Vizagapatam, June 18, 1872.

ON THE OCCURRENCE OF NATIVE SULPHURIC ACID IN EASTERN TEXAS.†

By J. W. MALLET, Ph.D., M.D.,
Professor of Pure and Applied Chemistry, University of Virginia.

NOT far from the Gulf of Mexico, and within twenty-five or thirty miles to the westward of the Neches river, there occur at several localities—in some instances in the woods, in others in the midst of open prairie—small drainage-wells and shallow pools of water strongly sour to the taste. This sourness is due to the presence of free sulphuric acid, which is accompanied by various salts, especially aluminium and iron sulphates. At most of these points gases are continually escaping (hydrogen sulphide, marsh gas, and carbonic anhydride), the bubbles burning readily on the application of a light.

At the bottom of the water in some instances, as at one point where, by means of an artificial bank, a pond has been formed of some 250 feet in diameter, known locally as the "sour lake," an earthy crust with intermingled

* I use the term "guarded," as it expresses the effect very well. Nitrous waters may be evaporated down with ammonium sulphate without fear of platinum vessels being attacked, as would be the case in presence of free sulphuric or hydrochloric acid.

† Read before the British Association, Brighton Meeting, Section B

ree sulphur is observable. A thick, tarry variety of petroleum is found oozing from the surrounding soil, occasionally to such an extent that sods taken up with a spade are set on fire and used to give light in the open air at night.

At a point in Louisiana some fifty or sixty miles further East, where, however, the acid water does not occur, though combustible gas and petroleum are met with on the surface, a most remarkable bed of native sulphur, 100 *feet in thickness*, has been reached at the depth of 450 feet by boring, and a shaft is being at present sunk for its exploitation. This large mass of native sulphur is more or less mingled with calcium carbonate, and underlaid by gypsum. The circumstances connected with the occurrence together in this region of combustible gases, petroleum, sulphur, sulphuric acid, and gypsum are of great interest in relation to the mineral history of native sulphur.

The sulphuric acid water, which seems to be probably altogether of superficial origin, is worthy of notice from the unusual strength occasionally attained. The water varies very much at the different localities and at different times. In one instance, a specimen examined by Dr. Mallet contained no less than 5·290 grms. of free sulphuric acid (H_2SO_4) to the litre, or 370 grs. to the imperial gallon, this exceeding any amount hitherto reported from other localities, unless the acid spring of the Paramor de Ruiz, in New Granada, be an exception, examined by Lewy, who does not state precisely how much of the very large quantity of sulphuric acid found is uncombined with bases. The water of the Rio Vinagre, flowing from the volcano of Purace in the Andes of Popayan, as described by Humboldt and Boussingault, contains only 1·11 of free sulphuric acid (SO_3?) in 1000 parts of the water, with 0·91 of hydrochloric acid.

It is said, on the authority of Confederate officers serving West of the Mississippi, that during the blockade of Southern ports the galvanic batteries of telegraph offices in Texas and Western Louisiana were worked with this native sulphuric acid.

NOTE ON A CITRATE OF BARIUM.

By E. SONSTADT.

Chemical text-books describe a class of citrates to which the formula $C_{12}H_{11}M_5O_{14}$ is assigned, and which might be called di-tri-metallic citrates, since the formula may be obtained by addition of the formulæ of a di- and of a tri-metallic salt. As this formula differs but little from the formula of a citrate shown, in my paper on "The Oxidating Power of Iodide of Potassium," to be chemically neutral in reference to a liquid there described, and in which the number of atoms of metal are to the number of atoms of hydrogen as 1:2; it occurred to me as probable that the formula given in the books may have been incorrectly given to salts really constituted according to the formula $C_6H_5\frac{1}{4}M_2\frac{3}{4}O_7$, or the double of that, $C_{12}H_{10}\frac{3}{4}M_5\frac{1}{2}O_{14}$. Since salts of this kind must be prepared for analysis by drying at a temperature not far removed from that at which they begin to decompose, a doubt being thus introduced as to the perfectness of their preparation, it seemed useless to attempt by analysis to establish entirely beyond doubt which of the two formulæ is correct,—especially as the percentage of metal in the two cases respectively can differ but very little in respect to the total weight of salts taken for analysis. But the formula in which the proportion of metal to hydrogen is given as 5 : 11, is satisfied by adding one atom of citric acid to five atoms of a tri-metallic citrate; whereas the formula requring 1 : 2 is satisfied by adding one atom of citric acid to eight atoms of a tri-metallic citrate,—a difference wide enough to admit of very satisfying experiments.

Eight parts by weight of citric acid were exactly saturated by solution of carbonate of sodium, so that the reaction was neutral to litmus-paper. 1 part of citric acid was dissolved in the liquid, solution of chloride of barium added in excess, and then about twice the volume of the liquid of alcohol. The liquid, filtered after a while, was neutral to test-paper, or had only a scarcely recognisable acid reaction. Hence the precipitate of barium citrate formed must have contained the whole of the citric acid employed, and therefore the barium was to the hydrogen in the citrate as 1 : 2. In other experiments, when a larger proportion of citric acid to tri-metallic citrate was used, the alcoholic filtrate was always strongly acid.

Quantitative experiments were now made, in which 1 part of citric acid was taken to 5 parts of citric acid for neutralisation; and, in one case, 3 atoms acid to 10 atoms tri-metallic citrate. Weighed quantities of chloride of barium, adjusted to give neither excess nor deficiency, were added; and the acid in the alcoholic filtrates was estimated by a standard alkaline solution. In the first three experiments, the amount of citric acid in the precipitates (over what was included as tri-metallic citrate) was also estimated, by boiling these precipitates with sulphate of potassium in excess, and neutralising the solution by the standard alkaline solution. As the sum of acid found in filtrates and precipitates agreed nearly with the total excess of acid over what was needful to form tri-metallic citrates, in the remainder of the experiments the acid in the filtrate only was directly observed, that carried down in the precipitates being calculated.

In four experiments, in which 5 parts of citric acid were neutralised by soda, 1 part citric acid added, and then chloride of barium in equivalent proportion, and alcohol, the acid in the filtrate to that in the precipitate were—(1) 12 : 28; (2) 12 : 28; (3) 12 : 28; (4) 15 : 25, but in this (4) the experiment was varied by adding the chloride barium to the citrate formed by neutralising the 5 parts citric acid taken, by soda, then alcohol, and *lastly*, the reserved part of citric acid. In experiment (5) 3 parts citric acid were used to 10 parts acid neutralised by soda; or one-third more citric acid than necessary to give the salt $C_{12}H_{11}M_5O_{14}$. The proportion formed in this case of acid in filtrate to acid in precipitate was 28 : 32. If the citrate of barium formed in these experiments had the composition $C_{12}H_{11}13a_5O_{14}$ there could, in experiments (1) to (4), have remained *no* acid in the filtrates. In experiment (5), it would have been as 20 : 40. The formula $C_{12}H_{10}\frac{3}{4}Ba_5\frac{1}{2}O_{14}$, requires the proportion of acid in filtrates, and precipitates in experiments (1) to (4) to be as 3 : 5, or as 15 : 25; and in experiment (5), as 35 : 25. In each experiment, therefore (except in (4) where the proportion agrees with theory), a small proportion of acid over the proportion required by theory was carried down, and the proportion thus carried down was largest in experiment (5), where the citric acid was used in largest excess. It might be supposed that possibly a di-tri-metallic barium citrate may have been formed in these experiments, and that the acid found in the filtrates was due to the solubility of such barium salt in alcohol. In such case, the proportion of barium in the filtrates should be proportional to the acid found in them. In experiment (5), where, evidently if this is so, a larger proportion of barium should be found in the filtrate than in the other experiments, the barium was quantitatively determined, and found a little under 2 per cent of the barium in the precipitate. It seems impossible, therefore, to deduce any other conclusion from these experiments, than that the formula $C_{12}H_{10}\frac{3}{4}Ba_5\frac{1}{2}O_{14}$ (and not $C_{12}H_{11}Ba_5O_{14}$), is correct for the salt in question.

I endeavoured to obtain a corresponding ammonium salt, by drying up tri-metallic ammonium citrate on the water-bath. Ammonia, however, was continuously given off, and the glutinous mass remaining, still smelling of ammonia, was found to have parted with nearly half (six-thirteenths) of the ammonia originally contained in the salt. The behaviour of ammonium citrate at the tem-

perature of boiling water, is therefore comparable to that of ammonium phosphate at a much higher temperature.

When 8 parts citric acid are saturated with soda, and 1 part acid added, a crystallised salt is obtained by long standing of the concentrated liquid, with difficulty. The crystals consist of tri-metallic citrate. It does not appear, therefore, that the salt $C_{12}H_{10\frac{5}{8}}Na_{5\frac{1}{8}}O_{14}$ is crystallisable. But alcohol precipitates from a solution of this salt a dense fluid, and the supernatant liquid is only slightly acid to test-paper.

As the existence of a class of salts containing fractional atoms of base appears inconsistent with the etymological meaning of the word "atom," and opposed to the most commonly received "atomic theory," I propose to carry these researches further as I may have opportunity. Should other tri-atomic acids than citric acid be found to give corresponding salts, the discussion of the theoretical bearings of the existence of such salts will be much simplified, because they can then be viewed apart from the special constitution of a single organic acid which is supposed by some to be derived from a triple molecule.

CHANGES PRODUCED IN THE GLOBULES OF THE BLOOD AND THEIR RELATION TO SECRETIONS.

M. Ritter, of Strasburg, in a recent thesis to the Paris Faculty of Sciences, discusses this question; having investigated the action of the following substances on the blood globules, and correlatively on the excretal humours, viz., oxygen, protoxide of nitrogen, oxide of carbon, compounds of antimony and of arsenic, phosphorus, and biliary acids. We give an abstract of his results.

Action of Oxygen.—Since the discovery of oxygen, its action on the blood and tissues has been studied by various physiologists; to whose works M. Ritter makes reference. MM. Demarquay and Leconte observed that animals could breathe pure oxygen a long time without inconvenience, and that the pulse was sometimes accelerated, and a feeling of comfort produced. Allen and Pepys inferred from experiment that the quantity of carbonic acid excreted increased with oxygenation of the air: but this has been denied. M. Ritter studied especially the influence of oxygen on urinary excretions. He submitted himself to a fixed daily diet, producing a certain quantity of urine, and he compared the urine of days on which he absorbed pure oxygen with that of other days on which he did not do so. In the former case he inhaled 25 to 30 litres of oxygen, inspiring the gas gently from a gasometer, as when one smokes. From analysis of the urine obtained under these conditions, M. Ritter found the acidity increased, the quantity of nitrogen and of urea diminished, the uric acid diminished, and the ammoniacal salts increased considerably. The products were those of advanced oxidation.

This urine obtained after inhalation of oxygen, underwent acid fermentation very quickly, and remained acid for a long time, sometimes not becoming alkaline till after two months; and he asks if therapeutical science might not take advantage of this fact in affections in which the urine has a pronounced tendency to ammoniacal fermentation, and if inhalation of oxygen might not happily modify this morbid property.

M. Ritter did not experience the feeling of comfort referred to by other physiologists; his pulse became less rapid, but fuller, the legs felt somewhat benumbed.

Comparing the urine produced in states of repose and in states of muscular activity, M. Ritter found, that after a state of complete repose, walking produces phenomena of oxidation different from those observed after inhalation of pure oxygen. The quantity of nitrogen eliminated in the urine is increased instead of diminished, and the proportion of urea to uric acid increases nearly one-half.

Action of Protoxide of Nitrogen.—M. Ritter obtained the gas from nitrate of ammonia in a retort placed in an oil-bath heated by gas, so that the temperature of the salt was raised to +230°; the gas being produced at the rate of about 6 litres per hour. It traversed tubes containing litmus, potash, ferrous sulphate, and pyrogallate of potash, and was collected over water from which the air had been expelled by boiling. It could thus be had very pure.

According to M. Ritter, protoxide of nitrogen is a very poisonous gas. For example, a pigeon placed in a receiver containing 80 per cent of the protoxide, died immediately. When defibrinated blood is agitated with protoxide of nitrogen it is reddened as by oxygen; but after some time it becomes bluish-red. M. Ritter considers that the protoxide is first absorbed by the globules and then expelled by the oxygen of the serum.

He experimented with pigeons, rabbits, and frogs, and found that protoxide of nitrogen, mixed with its own volume of air, always diminishes the oxidation, and cannot sustain life. The inhalation of a volume of air containing $\frac{1}{10}$th of protoxide diminishes considerably the quantity of carbonic acid, but without stopping the respiration. If this proportion is reduced to $\frac{1}{20}$th, the quantity of carbonic acid does not sensibly alter. Thus we see that in 50 per cent of protoxide of nitrogen life is impossible; in 5 per cent it is not at all deranged.

Next as to the effect on urinal excretion, M. Ritter drank water saturated with the protoxide, and he found that all the immediate principles of urine were increased; there was diuresis. When the absorption of the gas was continued, the proportion of uric acid to urea rose considerably.

Action of Oxide of Carbon.—M. Bernard has shown that blood mixed with oxide of carbon loses its gases, and especially its oxygen, in a very short time. The oxide prevents hæmatosis, and kills the blood. Examining the effects of this substance absorbed in doses which were not toxical, M. Ritter found diminished oxidation, and the urine to have become albuminous, containing both albumen and albuminose.

Action of Compounds of Antimony.—M. Ritter employed the emetic and sulphuret of antimony, studying their effects on men, rabbits, dogs, and geese. Having taken, for some time, 5 milligrammes of emetic daily, he did not obtain very distinct results on analysis of the urine, but it appeared that the principles of oxidation were somewhat diminished. The same is to be said of dogs, which were given 15 and 20 milligrammes of emetic daily. Their urine did not contain morbid principles.

In some parts of Germany, glass of antimony is mixed with the paste given to geese, with the view of fattening them. M. Ritter wished to test the value of this idea, and found that under the influence of 5 and 10 centigrammes of sulphuret of antimony daily, the sugar and fat of a goose increased very little. There was no alteration in the globules. With stronger doses, the quantity of fat did not further increase. The blood contained less carbonic acid and oxygen.

Action of Arsenious Acid.—The result of experiments, on geese chiefly (the dose of arsenic ranging from 5 to 20 milligrammes) was that small doses produced a considerably greater formation of fat, while strong doses caused emaciation. (M. Ritter believes the custom of giving geese glass of antimony to fatten them, is really based on the fattening effects of arsenic, which glass of antimony always contains). The globules of the blood were only altered by very strong doses. Crystals of hæmoglobin were sometimes met with. In this case the urine was icteric and albuminous. Glucose increased in the plasma. M. Ritter adds, that in his experiments with men, he never met with the colouring and *embonpoint* which are said to result from arsenicophagy.

Action of Phosphorus.—Two milligrammes were given daily to dogs; in 10 or 12 days they became icterically diseased, and were then killed. The urine contained bile and albumen, and was less acid and less rich in urea.

The blood contained a large proportion of fatty matter and of cholesterine. The globules were viscous, and a little deformed. Other dogs, to which 10 milligrammes were given daily, were killed after a week. The blood was violet, and crystallised under the objective of a microscope, though the crystals were rare. The deformed globules had a raspberry appearance. All the organs showed fatty degeneration. The urine contained albumen, hæmoglobin, and biliary pigments, and was alkaline. Geese were very sensitive to the action of phosphorus, and could only bear it in very small doses. The general result was, that deposits of fat in the liver and various members were notably favoured by small doses of phosphorus, but strong doses had no such action.

Action of Biliary Acids.—In some cases, M. Ritter bound the choledochus, and, in others, injected salts of biliary acid into the veins. In every case the blood was greatly changed, showing crystals of hæmoglobin, and divided globules. It became richer in fat and cholesterine; the temperature fell. Analysis of the urine gave the same results as in the case of phosphorus. Salts of the bile acted more quickly and energetically than the phosphorus compounds. The colouring matters of the bile, on the other hand, had no toxical properties.

M. Ritter's *resumé* of results is briefly as follows:—When animals are subjected to the action of substances which greatly alter the blood globules (as compounds of antimony, arsenic, and phosphorus), crystals of hæmoglobin appear in the deformed globules; the blood is anemic, the albumen in the globules diminishes; the fibrin increases, the proportion of gas diminishes, glucose generally, but not always, increases; fatty matters and cholesterine always increase; and the variations in these correspond to the dose of the poison and the alteration in the globules. The composition of the urine varies also; the entire quantity of nitrogen and urea diminishes; the acidity diminishes and gives place to alkalinity; uric acid always increases, when the globules are greatly changed. The urine contains abnormal principles, which are most frequently colouring matters of the bile, albumen, and sometimes hæmoglobin. The compounds whose action we are considering promote formation and deposition of fat, but only when administered in certain doses.

A. B. M.

DETECTION OF BISMUTH BY THE BLOWPIPE, IN THE PRESENCE OF LEAD AND ANTIMONY.

By H. B. CORNWALL, E.M.

Bismuth may be readily detected in the presence of antimony by the blowpipe. So likewise when with lead, by the salt of phosphorus bead and tin, even if only 0·05 per cent of teroxide of bismuth is present in otherwise pure oxide of lead. Antimony, however, yields a similar reaction with salt of phosphorus, and it has always been necessary to resort to the wet way to settle, with certainty, the presence of little bismuth with much lead and antimony.

Von Kobell's observations (*Journal fur praktische Chemie*, No. 10) on the behaviour of bismuth compounds with a mixture of equal parts of iodide of potassium and sulphur, noticed in the Chemical News, vol. xxiv., p. 110, suggested to the writer the use of this reaction in mixtures of the three metals, or their compounds. According to von Kobell, any bismuth compound, treated B. B. with the iodide mixture on a large coal, affords a beautiful and very characteristic red coat, at quite a distance from the assay. The writer has always obtained the reaction by employing teroxide of bismuth and iodide of potassium, entirely free from sulphur, but the sulphur adds exceedingly to the delicacy of the test.

With the view above stated, the writer made the following experiments, by heating on coal with the iodide mixture, different compounds:—

(1). Teroxide of bismuth. The red bismuth coat was beautifully formed.

(2). Protoxide of lead, free from bismuth. A copious and bright yellow coat was formed, as far from the assay as the bismuth coat.

(3). Oxide of lead, with 10 per cent teroxide of bismuth. At first a slight, but marked, red bismuth coat, quickly covered by the lead coat; which, however, had a pale orange tint, showing bismuth.

(4). Oxide of lead with 5 per cent teroxide of bismuth. A yellow coat, in no way distinguishable from that in Expt. 2. By heating a fresh portion of the oxide of lead and iodide mixture and letting the fumes condense, for a moment only, on the cold yellow coat already formed, this assumed a dark orange shade, but the reaction was far less characteristic than that obtained in Expt. 7.

(5). Oxide of lead with 1 per cent teroxide of bismuth. A coat perfectly resembling that in Expt. 2.

To increase the delicacy of the test, experiments were made in open tubes, 4 in. long, and not less than ⅛ in. wide, over a Bunsen gas burner. A spirit-lamp answers as well. The iodide mixture now used contained 5 parts sulphur and 1 part iodide of potassium, by weight; and about equal volumes of this and of the metallic oxides were used. The iodide and sulphur mixture of equal parts no longer served the purpose.

(6). Oxide of lead. First, part of the sulphur sublimed and condensed above the assay, its heavy vapours also burning at the lower end of the tube. Then, copious yellow fumes passed through the tube, and an abundant sublimate condensed, which commenced about one-third of an inch above the assay, and when *quite cold* had a pure, bright yellow colour.

(7). Oxide of lead with 1 per cent teroxide of bismuth. The same phenomena as in Expt. 6, but one-third of an inch above its lower edge the yellow sublimate was replaced by a broad and distinctly red ring of the bismuth sublimate.

(8). Oxide of lead with ¼ per cent teroxide of bismuth. As in Expt. 7; the bismuth sublimate, however, being rather orange-red, but so distinctly marked as to leave no doubt that even a less proportion of bismuth could have been certainly detected.

(9). 50 parts oxide of lead, 50 parts teroxide of antimony, and 1 part teroxide of bismuth. The white antimonial sublimate entirely concealed the bismuth reaction. To obviate this the mixture of the three oxides was mixed with an equal volume of sulphur and treated B. B. in a deep cavity on coal, with the blue flame, for a few moments. The resulting fused sulphides were removed to a flat coal, and treated alternately with the O. F. and R. F. until the antimonial fumes had nearly ceased, and an impure blue lead flame appeared. The residue was powdered, and a portion of it treated with iodide mixture on coal. No bismuth was detected. The other portion was treated as before in the open tube, when a distinct bismuth sublimate formed, about one-third of an inch above the lower edge of the yellow sublimate. The experiment was repeated with like success on equal parts of oxides of lead and antimony containing ½ per cent and ¼ per cent of teroxide of bismuth; and, as was to be expected, the bismuth reaction was more distinct than when the bismuth was present with lead only.

Therefore, to detect oxide of bismuth in mixtures of oxides of lead and antimony, follow the method given in Expt. 9, if there is not any decisive result obtained by the test on coal. If sulphides are under treatment, remove the excess of antimony on coal, as above.

Care must be taken not to confound with the bismuth sublimate a sublimate of iodine, which may condense on the upper part of the tube, but at a greater distance from the assay.—*American Chemist.*

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ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

(Continued from p. 142).

Annatto is the pulpy part of the seeds of the *Bixa orcellana*, which grows in South America. It is imported into this country from Mexico, Brazil, the Antilles, and especially from Cayenne, in masses covered with leaves, and varying in weight from 5 to 20 lbs. It is also imported in casks, weighing 4 or 5 cwts., as a homogeneous paste of the consistency of butter, and often having a repulsive odour of urine, which, it is stated, is added by those who store it, to keep it moist and to impart to it a richer hue.

At Cayenne, when the fruit of the bixia is ripe, it is gathered, coarsely crushed, and thrown into water, where it remains for several weeks. By this means the pulpy matter is separated from the kernel. It is next strained through a coarse cloth, and the colouring-matter gradually subsides. It is then collected, and the excess of water evaporated, until it assumes a pasty state, when it is exposed to the atmosphere in the shade until sufficiently dry to be shipped. The powder so prepared, and especially at Cayenne, is comparatively inferior, owing to the mass fermenting and producing matters which prove injurious in the drying process. The following analysis may be taken as the average composition of such qualities of annatto:—

Water	72·25
Leaves	3·85
Starch, mucilage, woody fibre	18·30
Colouring-matter..	5·60
	100·00

Some thirty years ago, a M. du Montel introduced at Cayenne some marked improvements in the manufacture of annatto. He suppressed the crushing of the seeds, separated the colouring-matter by water, and prevented the fermentation by the addition of some chemical fluid. By this means he obtained annatto in a minute state of division, and having a very beautiful red colour, which is imported into this country in the form of small tablets, which are much used for colouring cheese.

An alkaline solution of annatto gives an orange precipitate with acids, alum, or sulphate of protoxide of iron, a yellowish brown precipitate with salts of copper, and a lemon-coloured precipitate with chloride of tin.

The colouring matters of annatto have been studied by MM. Chevreul, Kerndt, and Bolley. It contains two colouring matters, one a yellow, which is soluble in water and alcohol, but insoluble in ether, and which gives a yellow colour to cloth mordanted with alum. It has received the name *orelline*, and its formula is $C_{12}H_{22}O$. According to Kerndt's statement, however, it is only a product of the decomposition of the second colouring-matter, the real colour-giving principle of annatto being *bixine*, $C_5H_6O_2$. Bolley proposes the following method to obtain bixine:—The best quality of annatto from Cayenne, after having been washed and dried, is boiled with concentrated alcohol; the alcoholic solution is evaporated to dryness, and placed to digest with ether, which dissolves a part of the residue, leaving a bright red powder, insoluble in water, but soluble in soap and alkalies, to which it imparts an orange tint, and yields a dark blue colour with sulphuric acid.

The use of annatto in print and dye works is rather limited, its chief employment being to modify the shades of other dyes, such as certain tints of yellow produced by fustic or quercitron. It is also used to give a bottom to cotton before it is dyed with safflower or cochineal. In the production of oranges in steam styles, annatto is now entirely superseded by *aurine*, a colour derived from carbolic acid. It is still often used in dyeing a low class of cotton yarns. The yarn is dipped in an alkaline solution of annatto, and then passed through a weak solution of oil of vitriol which precipitates the bixine in the fibre. It is then only necessary to wash the cotton to complete the operation. If an orange-yellow tint is required, the cotton is previously mordanted with tin.

Ilixanthine is the name given to the pale primrose yellow crystals obtained by Dr. Schunck from the leaves of the *Polygonum fagopyrum*, or common buckwheat. This body, to which he gives the formula $C_{30}H_{20}O_{20}$, is only sparingly soluble in hot and cold water, but more soluble in alcohol. Strong sulphuric acid changes its colour to a deep yellow without decomposition. It yields on a piece of calico mordanted with alumina a dark yellow colour, with tin a light yellow, and with oxide of iron various shades of yellowish brown, according to the strength of the mordant employed.

Lo-kao.—In 1851 and in 1852, public attention was drawn by several English gentlemen to samples of a green colouring matter imported from China; in 1853, Messrs. Guinon, of Lyons, imported such quantities as to enable them to dye silk for the requirements of the trade. The silks so dyed were known by the names *Vert-Venus*, *Vert-Azof*, and *Vert-Lumiere*, and were especially admired from their remaining green in artificial light. They are not, however, now produced, as the colours were unstable, and Messrs. Guinon, Mamas, and Bonnet, found that they could produce greens which maintain their colour in artificial light by first dyeing their silks in Prussian-blue, and then immersing them in an acidulated bath of picric acid. It is interesting to observe that, if indigo be substituted for Prussian-blue, the colour appears blue by artificial light.

Lo-kao is the only substance with which I am acquainted, capable, with proper reagents, of producing the seven colours of the spectrum.

M. Charvin, of Lyons, obtained lo-kao from a weed indigenous to Europe—the *Rhamnus catharticus*, and received for his discovery a gold medal, worth 6000 francs, from the Chamber of Commerce of Lyons. All these vert-lumieres are, however, now replaced by the brilliant greens obtained from aniline.

Tannin matters can be divided into two classes, those which give a blue-black precipitate with persalts of iron, such as gall-nuts, sumach, divi-divi, myrobalans, and valonia, and those which give a green colouration with persalts of iron, such as catechu, gambier, gum kino, and elder, larch, and willow barks.

The first class are characterised by containing two acids, which have received the names of tannic and gallic acids.

Tannic acid, which is the all-important compound in this class of substances, was extracted some years ago by the following simple process, devised by M. Pelouze. It consists in treating in a displacement apparatus, coarsely ground gall-nuts with ether which has been previously well shaken with water (during this process it has taken up one-tenth of its weight of the water). The ethereal solution, on being allowed to stand, separates into two layers, the upper one being nearly pure ether, and the lower one being an aqueous syrupy solution of tannin, which only requires to be evaporated in a water-bath to obtain the tannic acid as a pale yellow spongy mass, inodorous, and having a most astringent taste. As is seen by the process of extraction, it is soluble in water, but insoluble in ether. It is soluble in alcohol. It is characterised by giving a blue-black precipitate with persalts of iron, but none with protosalts, and a white precipitate with tartar emetic or salts of lead. It gives a precipitate with gelatine and the vegetable alkaloids, and turns rapidly brown or black in presence of air and caustic alkali.

Tannic acid is a glucoside, decomposed by acids into a

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

peculiar sugar and gallic acid, as seen by the following formulæ:—

Tannic acid. Water. Gallic acid. Sugar.

$$C_{27}H_{22}O_{17} + 4H_2O = 3(C_7H_6O_5) + C_6H_{12}O_6$$

Gallic acid presents itself under the form of fine, white, silky needles, and is soluble in water, alcohol, and ether. Under the influence of a temperature of 410° F., it unfolds itself into carbonic acid and a beautiful white crystalline compound called pyrogallic acid, which has of late years been extensively employed in photography. If the temperature be raised to a higher point than the one above mentioned, gallic acid is decomposed into carbonic acid, water, and gallhumic acid. The first decomposition may be represented by the formulæ—

Gallic acid. Carbonic acid. Pyrogallic acid.

$$C_7H_6O_4 = CO_2 + C_6H_6O_3$$

the second as—

Gallic acid. Carbonic acid. Water. Gallhumic acid.

$$C_7H_6O_5 = CO_2 + H_2O + C_6H_4O_2$$

Gallic acid has been produced artificially by the action of potash on a di-iodosalycilic acid. When sulphuric acid is made to act on gallic acid, it transforms it into a red acid called rufigallic, which has the formula $C_7H_4O_4$. When in contact with alkalies, in presence of air, gallic acid, like pyrogallic and tannic acids, and various other organic substances, rapidly absorbs oxygen, as was shown by M. Chevreul in 1820. On this fact, Liebig, in 1838, founded an elegant method of determining the amount of oxygen in a mixture of gases. The process, is however, only approximately correct, as I proved in 1863, that under these circumstances oxide of carbon was liberated.

Gallic acid gives a purple-black precipitate, with per-salts of iron, but none with the proto-salts. It gives no precipitate with gelatine, which is a most important fact, as I shall now proceed to show.

Tannin matters, such as oak-bark, are employed for tanning leather, and the conversion of a hide into leather depends on the gradual transformation of the animal matter which it contains into gelatine. This combines with the tannic acid, producing an insoluble compound which fill the pores of the animal tissue, and thus contributes, not only to prevent its putrefaction, but to render it impermeable to water. The value, therefore, of a tannin matter depends on the amount of tannic acid it contains, the gallic acid taking no part in the tanning of the hide.

Tannin substances, such as gall-nuts, sumach, or bark, contain a ferment, which is susceptible of unfolding the glucoside tannic acid into sugar and gallic acid. It is necessary, therefore, that the tanner take great care in the management of the vats, to prevent any fermentation, especially the one called ropiness, for in such a case the vat would become useless. As it is a difficult matter often in summer to prevent this state of things, I may state that I have found that the addition of a few thousandths of carbolic acid is sufficient to prevent these chemical changes, without interfering with those which must take place in the hide.

Tannin matters, as you are aware, are much employed for producing blacks on fabrics, mordanted with per-oxide of iron. I asked myself some years since, whether it was the tannic or the gallic acid which produced the black, or if both participated in its production, and the results of my experiments clearly proved that tannic acid alone took part in its formation. This may be seen if two pieces of calico mordanted with iron are dipped, the one in a solution of tannic acid, and the other in a solution of gallic acid. Both pieces at first become dyed, but after a few days, the one dipped in tannic acid remains black, while in the one dyed with gallic acid the colour has disappeared, the gallic acid having reduced the per-oxide of iron to the state of protoxide, which, as I have already remarked, does not produce a black with these acids.

As gallic acid is of no value to the dyer as a colour-giving principle, he must take care that his tannin matters, such as sumach, are carefully stored and kept dry, so as to avoid any gallic fermentation taking place, which would decrease the amount of tannin they contain. He should also avoid holding a large stock, as the fermentation above mentioned slowly proceeds in the tannin matters, as is proved by the fact of sumach, for example, decreasing considerably in value, after it has been some time prepared.

(To be continued.)

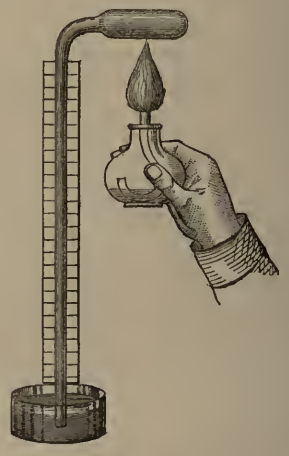
ON MEASURING TEMPERATURES BY ELECTRICITY.*

By C. WILLIAM SIEMENS, D.C.L., F.R.S., M.R.I.

The truth revealed to us by one of the younger branches of physical science, which has been cultivated and expounded nowhere more effectually than within these walls, has divested heat and electricity of their mysterious character, and has taught us to regard them simply as "modes of motion."

Light also has been shown to be identical in its nature with heat, and the only remaining physical agency, "chemical affinity," has been recognised as a force differing only in "quality of action" from the others. According to these views, force, in whichever type of action it presents itself, is as *indestructible as matter itself*, and is therefore capable of being *stored* up and *measured* with the same certainty of result. We have a

Fig. 1.



unit of force or the foot-lb., and a unit of heat, or the heat necessary to raise the temperature of 1 lb. of water through 1° F., and it has been already proved that 772 units of force are the equivalent value of one unit of heat. Again, the chemical force residing in 1 lb. of pure coal is equal to about 14,000 heat units, or $14{,}000 \times 772 = 10{,}808{,}000$ ft.-lbs. = 4825 tons lifted 1 foot high.

Questions regarding the quantitative effects of heat present themselves, however, much less frequently for our consideration than questions regarding its *intensity*, upon which depends the nature of the phenomena surrounding us at every step, both in science and in ordinary life. The instrument at our command for

* Read before the Royal Institution of Great Britain.

determining moderate intensities or temperatures, the mercury thermometer, leaves little to be desired for ordinary use; but when we ascend in the scale of intensity, we soon approach a point when mercury boils, and from that point upward we are left without a reliable guide. The result is, that we find in scientific books on chemical processes, statements to the effect that such or such reaction takes place at a *dull red* heat, such another at a *bright red*, a *cherry-red*, a *blood-red*, or a *white* heat—expressions which remind one rather of the days of alchemy than of chemical science of the present day.

There are pyrometers, it is true, but these are either of a complex nature, or little reliance can be placed on them.

It is my purpose this evening to place before you an instrument by which I hope to fill up to some extent the existing gap. It is the result of occasional experimental research, spread over several years, and it aims at the accomplishment of a double purpose, that of measuring high temperatures, and of measuring with accuracy the temperatures of *inaccessible* or *distant* places.

But before entering upon the details of my subject, I propose to place before you an instrument which fulfils, in principle, all the conditions essentially necessary in thermometry, and is at the same time the very first instrument that was ever proposed for measuring temperatures. I speak of the *air thermometer* by Galileo. It can be shown on theoretical grounds, that the expansion of a permanent gas at constant pressure is the most perfect index of temperature. It is, in fact, the degree of energy of the atomical motion in an elastic fluid which determines its volume, and which constitutes at the same time its temperature.

The air thermometer consists simply of a bulb of glass with a long tubular stem, open to the atmosphere at its extremity. If I heat the bulb (by dipping it for instance into boiling water) and put it into a holder, with the hollow stem reaching downward into a cup of mercury, the air within the bulb will no longer communicate directly with the atmosphere, because the mercury is interposed. If now I cool the air within the bulb, by the external application of iced water, its heat motion will diminish, and its volume would be reduced proportionally, if the external atmosphere could enter freely to fill up the vacancy thus created. But inasmuch as the external air cannot enter, a reduction of pressure will take place, which, according to the law of elasticity by Boyle, must be proportionate to the reduction of volume at constant pressure. The difference of pressure thus created between the bulb and the external atmosphere will be balanced by the column of mercury rising up into the tube, and the elevation to which the mercury attains is a true index of the temperature to which the air in the bulb had been previously heated. This is true with regard to all temperatures, from the lowest to the highest, and the instrument may be termed a universal thermometer. If the bulb could be cooled down to 273° C. below the zero point, it would follow by the law of Charles that the elastic pressure of air would be reduced to nothing, that is to say, the motion of the particles of air, which we call heat, would have ceased, and we should have reached the point of absolute zero, a point which has been theoretically established also by other means.

Practically, such an instrument would be most inconvenient: its indications would have to be corrected by calculation for barometrical variations; the capacity of the descending tube, which contains air not subjected to variation of temperature, would have to be taken into account, and no reliable observations could be arrived at, without taking special precautions, such as are only within reach of the experimental physicist.

[The other known methods of measuring ordinary and furnace temperatures were here passed in review, and the limits of their application pointed out. They were classified into:—

Thermometers, by expansion of liquids.

Thermometers, by the expansion of solids.

Pyrometers, by chemical decomposition of solids, comprising Wedgwood's and Deville's pyrometers.

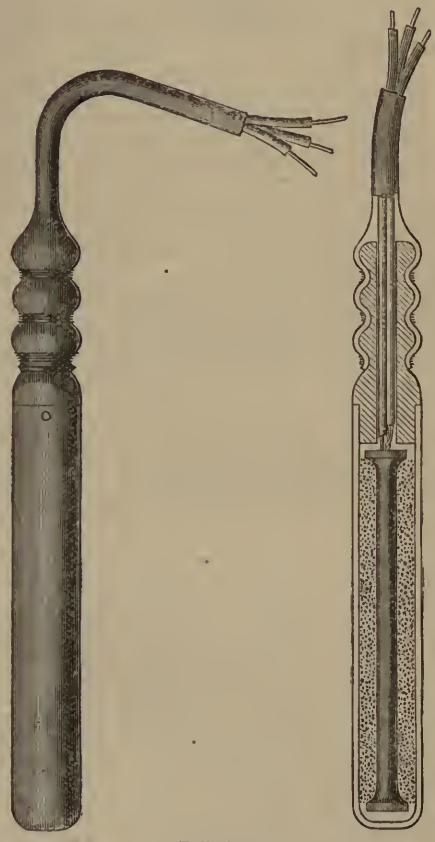
Pyrometers, by observing the melting-point of metals.

Pyrometers, by thermo-electricity.

Pyrometers, by exposing a copper or platinum ball of known heat capacity to the heat to be ascertained, and of quenching it in a measured quantity of water.]

The instrument which forms the subject matter of my discourse presents many points of analogy with the air thermometer, if we substitute "*electrical resistance in conductors*" for "*expansion of gases*"! Both these effects are functions of temperature, increasing with the temperature according to progressive laws, which in the case of the gases we call the *law* of *Charles*, and in the case

Fig. 2.



Full size.

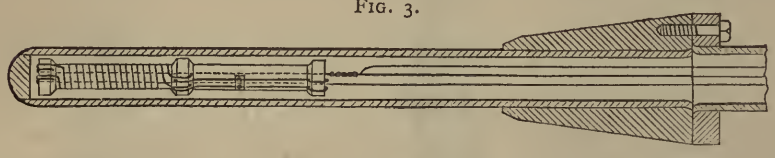
of conductors, the law of "*increase of electrical resistance with temperature*." The latter law, which is of recent origin, had already been partially developed by Arndsen, Swanberg, Lenz, and Werner Siemens, when my attention was directed, in 1860, towards an application of the same to the measurement of temperatures at places inaccessible to the ordinary thermometer. By means of the contrivance which I shall describe presently, I was enabled to tell, in the testing cabin of a cable-ship, the increasing temperature of the interior of the mass cable in the hold, and to prove the necessity of transhipment of the same into a vessel fitted with water-tight tanks, which have been resorted to ever since, to avoid the danger of softening the gutta-percha covering.

I have arranged an apparatus for proving to you in the first instance that the conductivity of a wire of platinum or other metal is greatly influenced by its temperature; for this purpose I direct the current of a galvanic battery

at will through two branches of equal resistance, each branch comprising a free spiral wire of platinum and one of the coils of a differential galvanometer. By throwing the powerful light of an electric lamp upon the face of the differential galvanometer, and by throwing the image by means of a mirror and lens upon the screen, the audience will see any movement of the needle to the right or the left that may take place when I complete the battery connection. The resistance of both branch circuits being the same, no deflection of the needle is observable on depressing the key, but when I pass the flame of a spirit-lamp under the one platinum coil the needle is thrown immediately over to the right, because the electrical resistance of the heated wire is increased, and consequently a larger proportion of the current is passing through the cooler circuit, exercising a preponderating influence upon the galvanic needle. When I withdraw the spirit flame from the wire, the needle rapidly returns to its zero position, but in passing it under the other spiral wire the needle immediately deflects in the opposite direction.

If, instead of using the open spirals, I were to wind thin insulated wire of any pure metal upon two small cylindrical pieces of wood, and were to enclose the tiny spirals in small silver casings, as shown (in view and in section) by Fig. 2, taking care that the extremities of the spiral wires were soldered to thicker insulated wires, leading respectively to the battery and differential galvanometer before mentioned, it follows that no deflection of the needle ensues when both the protected and equal spirals are dropped into a jar containing iced water. But if I take one of the spirals from the water, and place it, for instance, by his kind permission, into the hand of our President without disconnecting the same from its leading wires, the balance of resistance will no longer take place, and a deflection of the needle to the right actually takes place. I will now endeavour, however, to re-establish the equilibrium by adding warm water to the iced water surrounding the comparison coil near me until no deflection of the needle is observable. This result being obtained, it follows that the temperature of the water surrounding the one coil must be identical with the temperature of our President's hand, and the delicate mercury thermometer which I have placed in my solution must give me the temperature of the distant place which I intended to measure. The temperature here observed is 89·5° F., which is at this moment that of Sir Henry Holland's hands. This result is independent of the ratio in which the electrical resistance increases with temperature in the similar coils, and considering that the silver casings containing the coils are not larger than small pencil-cases, this method might be advantageously employed in physiological research. The one coil would only have to be placed within the cavity to be measured to enable the observer to read the temperature from time to time, without disturbing the patient, with the accuracy of which the mercury or spirit of wine thermometer employed is capable. But the same method is applicable for measuring the temperatures of distant or inaccessible places, such as the interior of stores or cargoes of materials liable to spontaneous combustion; of points elevated above the surface of the ground; or of great depths below for meteorological purposes; or for measuring the temperature of the sea continuously in attaching such a coil to the mariner's sounding-lead. An error would in such cases arise, however, through the uncertainty of the resistance of long leading wires, if a complete remedy of error from such a source had not suggested itself. This consists in uniting three separate insulated leading wires into a cable by which the distant coil is connected with the measuring instrument. One galvanic circuit passes from the battery through one of the leading wires, through the distant spiral, and back again through the second leading wire to the differential galvanometer and the battery, and the second passes from the same battery through the near coil, and through the third leading wire up to the distant coil without traversing the same, and back again through the second leading wire to the galvanometer and battery. Thus both galvanic circuits comprise the leading wires up to the distant coil, and all variations of resistance by temperature to which the leading wires may be subjected affect both sides of the balance equally. In constructing coils for measuring deep-sea temperatures, a large quantity of insulated copper or iron wire is wound upon a metallic tube open at both ends to admit the sea-water freely, in order to impart its temperature to the innermost layers of the insulated wire. The coil of wire is protected externally by drawing a tube of vulcanised india-rubber over it, which in its turn is bound round by a close spiral layer of copper wire, whereby the sea-water is effectually excluded from the sensitive coil. By these arrangements, the temperature of distant or otherwise inaccessible places can be accurately ascertained; but the method is limited to the range of temperature which can be obtained and measured in the comparison bath. In order to realise a pyrometer by electrical resistance, it is necessary to rely upon the absolute measurement of the electrical resistance of a coil of wire which must be made to resist intense heats without deteriorating through fusion or oxidation. Platinum is the only suitable metal for such an application, but even platinum wire deteriorates if exposed to the direct action of the flame of a furnace, and requires an external protection. The platinum wire used has, moreover, to be insulated and supported by a material which is not fused or rendered conductive at intense heats, and the disturbing influence of leading wires had in this case also to be neutralised. These various conditions are very fully realised by the arrangement represented on the diagram, Fig. 3.

Fig. 3.



Thin platinum wire is coiled upon a cylinder of hard-baked porcelain, upon the surface of which a double-threaded helical groove is formed for its reception, so as to prevent contact between the coils of wire. The porcelain cylinder is pierced twice longitudinally for the passage of two thick platinum leading wires, which are connected to the thin spiral wire at the end. In the upper portion of the porcelain cylinder the two spiral wires are formed into a longitudinal loop, and are connected crossways by means of a platinum binding-screw, which admits of being moved up or down for the purpose of adjustment of the electrical resistance at the zero of Centigrade scale. The porcelain cylinder is provided with projecting rims, which separate the spiral wire from the surrounding protecting tube of platinum, which is joined to a longer tube of wrought-iron, serving the purpose of a handle for moving the instrument. If the temperatures to be measured do not exceed a moderate white heat, or, say, 1300° C. = 2372° F., it suffices to make the lower protecting tube also of wrought-iron, to save expense. This lower portion only, up to the conical enlargement or boss of iron, is exposed to the heat to be measured. Three leading wires of insulated copper united into a light cable connect the pyrometer with the measuring instrument, which may be at a distance of some hundred yards from the same. They are connected by means of binding-screws at the end of the tube to three thick platinum wires passing down the tube to the spiral of thin platinum wire. Here two of the leading wires are united, whereas the third traverses the spiral, and joins itself likewise to one of the two former, which forms the return wire for two electrical

circuits, the one comprising the spiral of thin wire, and the other returning immediately in front of the same, but traversing in its stead a comparison coil of constant resistance. The measuring instrument may consist of a differential galvanometer as before, if to the constant resistance a variable resistance is added. If the pyrometer coil were to be put into a vessel containing snow and water, the balance of resistance between the two battery circuits would be obtained without adding variable resistance to the coil of constant resistance, and the needle of the differential galvanometer would remain at zero when the current is established. But on exposing the pyrometer to an elevated temperature, the resistance of its platinum coil would be increased, and resistance to the same amount would have to be added to the constant resistance of the measuring instrument, in order to re-establish the electrical balance. This additional resistance would be the measure of the increase of temperature, if only the ratio in which platinum wire increases in electrical resistance with temperature is once for all established. This is a question which I shall revert to after having completed the description of the pyrometric instrument.

(To be continued).

CORRESPONDENCE.

ESTIMATION OF COPPER.

To the Editor of the Chemical News.

Sir,—I have read Mr. Hugo Tamm's articles on the "Estimation of Copper," &c., and Mr. Alfred Allen's sensible remarks thereon, and I beg leave to say that it is incredible to me that any one should bring forward at this late day a method of determining copper which requires a precipitation, when the deposition of copper on platinum by the galvanic current affords so elegant and exact a process.

I am required occasionally to determine copper in pyrites, and never dream of using any other method than that of which the following is an outline. Treat the pyrites with nitric acid to complete oxidation of the sulphur, evaporate to dryness, and ignite gently; then treat with a small amount of boiling water, and sufficient ammonia to precipitate and re-dissolve the copper. Filter the blue solution from the silica, iron oxide, &c., wash the filter, concentrate the washings if need be, make the filtrate sharply acid with sulphuric acid, and plate out the copper on the inside of a platinum dish which is made the cathode of a battery of the two small Grove's cells, the anode being a stout platinum wire hung in the solution. For a tolerably close result—generally sufficient in technical work—the solution in ammonia may be omitted, and the copper directly plated over from the solution filtered from the silica, &c. This method is steadily gaining favour here, and I am surprised that it has not already supplanted *all* other methods.

I should be glad to hear any objection raised against it by some one who has given it a fair trial. For the exact determination of very minute quantities of copper no method can approach it.—I am, &c.,

J. M. Merrick.

Laboratory, 59, Broad Street, Boston, U.S.A.,
August 31, 1872.

PAPER FOR TELEGRAPHY.

To the Editor of the Chemical News.

Sir,—I read in the Chemical News, vol. xxvi., p. 60, that one of your correspondents ("T. R.") is desirous to obtain a good conductible paper, without being obliged to moisten the paper continually. I believe that I can be of some service to him, as I met with the same difficulty a couple of years ago, working in New York with the Caselli and the Lenoir autographic telegraph.

As you know, the telegram to be sent is written with an isolating ink on paper silvered by a very thin film of silver. This isolating ink was invariably composed of a gum resin solution, which had the effect of adhering to the points of the metallic comb, and thus interfering with the conductibility. I suppressed this gum ink, which I replaced by a strong solution of chromic acid, having the action of forming a chromate of silver, destroying the conductibility (being a bad conductor), and drying at once. I recommend your correspondent to employ it.

In order to obtain my receiving-paper prepared with ferrocyanide of potassium in a constant moist state, after a great many experiments I used glycerine, and obtained the very best results. I first prepare my solution of ferrocyanide of potassium, and then add the glycerine, about half of each solution. This preparation has been adopted by the Superintendent of the Western Union Telegraph, Mr. Ludovic, of New York, for the autographic telegraphs of Little. As for the points of contact, I prefer red copper to iron; the iron, being so soluble, spreads too much, and sometimes, when very fine lines are required, blots the work; copper has not the same effect.—I am, &c.,

C. Widemann.

15, Rue Trévise, Paris, Sept. 22, 1872.

POWERFUL GALVANIC BATTERY.

To the Editor of the Chemical News.

Sir,—A friend has just pointed out to me that in a number of your Journal about a month since, which I did not happen to see, questions were asked in your "Notes and Queries" with respect to my batteries. As it would take up too much of your space to answer the queries fully, and it is always more satisfactory to show a thing than give a description of it, I will only say that I shall be glad, by appointment, to show anyone the construction of my batteries, and to show them a copy of the figures resulting from the experiments which I went through to ascertain the points on which I was to give explanations.—I am, &c.,

H. Highton.

2, The Cedars, Putney, Sept. 19, 1872.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, September 16, 1872.

This number contains no original papers relating to chemistry; the contents are chiefly devoted to astronomy.

Annalen der Chemie und Pharmacie, No. 10, 1872.

This number contains the following original memoirs and papers:—

Mononitro-Resorcin.—P. Weselsky.—While trinitro-resorcin is easily prepared by treating resorcin with nitro-sulphuric acid, the mono-, nitro-, and dinitro-resorcin are obtained with difficulty. By direct nitration, the author obtained mononitro-resorcin as a by-product of the preparation of diazo-resorcin. He describes at great length the method of purifying the mononitro-resorcin, which, in pure state, exhibits a pure lemon-yellow colour, is not bitter to the taste, is not explosive, and is not sublimable without decomposition; its fusing-point is 115°. The following bodies are also described:—Monobasic baryta salt—

$$C_6H_3NO_2\left\{\begin{matrix}Oba\\OH\end{matrix}\right.,4HO;$$

ydrochlorate of mono-amido-resorcin—

$$C_6H_3NH_2\left\{\begin{matrix}OH\\OH\end{matrix}\right.+HCl+2H_2O$$

bromnitro-resorcin fuses at 147°; formula—

$$C_6HBr_2NO_2\left\{\begin{matrix}OH\\OH\end{matrix}\right.$$

Constitution of the Phosphorus Compounds.—A. Michaelis.—The first instalment of an exhaustive monograph on this subject. Notwithstanding the high scientific value of the contents, elucidated by a series of algebraical and chemical formulæ, this paper is not suited for abstraction; it is divided into the following sections:—General introduction, treating on the phosphor compounds in general; sulphobromides of phosphorus; pyrophosphorus sulphobromide, $P_2S_3Br_4$; triethoxyl-pyrophosphor sulphobromide, $P_2S_3(OC_2H_5)_3Br$; pyrosulpho-phosphoric acid ethyl ether, $P_2S_3(OC_2H_5)_4$; diethoxyl-diethsulphyl-pyrosulpho-phosphoric acid ether—

$$P_2S_3(OC_2H_5)_2(SC_2H_5)_2;$$

orthophosphor sulphobromide, $PSBr_3$.

Formation of Sulphur Metals.—E. Priwoznik.—This memoir contains the record of some experiments made with different kinds of metals, by immersing them into a deep yellow-coloured sulphhydrate of ammonium, to which some sulphur had purposely been added; cadmium, lead, bismuth, antimony, zinc, and aluminium, are scarcely acted upon by being kept for several months in a solution of alkaline supersulphurets, care being taken that these metals are quite clean and polished previous to immersion; but, as regards copper, tin, silver, nickel, and iron, the case is different. Perfectly pure copper assumes a dark colour on being immersed in the sulphur compound of ammonium, and in a short time it is converted into monosulphuret of copper of a blue colour; but when the metal is kept immersed in the aforesaid solution for a considerable time, the blue colour changes to black, and, on analysis, the compound is found to be semi- or sub-sulphuret of copper, Cu_2S. Chemically pure silver becomes, as is generally known, very readily converted into sulphuret by the action of either sulphuretted hydrogen or alkaline sulphurets. When silver is exposed for a longer time to the action of the ammonium solution, the metal is converted into sulphuret of silver, Ag_2S. Tin also forms sulphur compounds under the above conditions, but, owing to the solubility of the sulphur compounds of tin in solutions of alkaline sulphurets, the tin is dissolved; 6·84 per cent of pure Banca tin had been dissolved in eight days. Nickel behaves like tin and iron (bright iron wire 1 m.m. thick), and is slowly and gradually coated with a thin layer of sulphuret.

Sulpho Acids of Mesitylen.—H. Rose.—This exhaustive essay is divided into the following sections:—Mesitylen-sulpho acid—

$$C_6(CH_3)_3H_2SO_3H+2H_2O;$$

baryta, lead, and magnesia salts of this acid; brom-mesitylen-sulpho acid from mesitylen-sulpho acid; baryta, lead, potassa, soda, lime, and copper salts of this acid (the formula of the copper salt is—

$$[C_6(CH_3)_3HBrSO_3]_2Cu+4H_2O);$$

brom-mesitylen-sulpho acid from monobrom-mesitylen and salts of this compound; nitro-mesitylen-sulpho acid from mesitylen-sulpho acid; formula of nitromesitylen-sulpho acid—

$$C_6(CH_3)_3HNO_2SO_3H+1\tfrac{1}{2}H_2O,$$

and salts of this acid; amidomesitylen-sulpho acid—

$$C_6(CH_3)_3HNH_2SO_3H+H_2O.$$

Studies on the Combinations of the Camphor Group.—J. Kachler.—The third instalment of a lengthy monograph on this subject; this part, elucidated by a series of complex formulæ, and extensive tables exhibiting the physical properties, sp. gr., boiling-point, vapour density, and behaviour with reagents, of several of the compounds of the camphor group, is divided into the following sections:—Borneol (camphol), $C_{10}H_{18}O$; phoron and camphren, $C_9H_{14}O$; camphrenic acid, $C_9H_8O_4$.

Monochlorocrotonic Acid Obtained from Croton Chloral.—C. Sarnow.—The preparation of monochlorocrotonic acid from trichlorocrotonic acid, by the aid of water and metallic zinc-powder, is described, along with the rather tedious process of purification, at great length. In pure state, monochlorocrotonic acid is a solid crystalline substance, difficultly soluble in cold, more so in boiling-hot, water, and very readily so in alcohol and ether; fusing-point, 96°; boiling-point, 212°, yet very volatile and sublimable at 100°. Although this acid agrees in many of its properties with monochlor-tetracrylic acid (first obtained by Geuther), it (monochlorocrotonic acid) is not identical therewith. A large number of salts and ethers of this acid are described at length, and, further, the following bodies:—Monochlorocrotonid, $(C_4H_4ClO.Cl)$; monochlorocrotonamid—

$$(C_4H_4ClO.NH_2);$$

monochlorocrotonitrile, (C_4H_4ClN); monochlorobibrombutyric acid, $(C_4H_4ClBr_2O_2)$; salts of this acid.

Some of the Derivatives of Dioxybenzoic Acid.—L. Barth and C. Senhofer.—Notwithstanding the scientific merits of this essay, its contents are not well suited for any useful abstraction.

Toluol-Disulpho Acid and some of its Derivatives.—C. Senhofer.—Toluol-disulpho acid is prepared by the action of a mixture of phosphoric anhydride and sulphuric acid upon toluol, the substances being placed in a tube, which, after having been sealed, is heated to 230° for some five hours. The purification of the raw material is a rather tedious affair; the author prepared some of the free acid, in pure state, from the baryta salt of the air-dry toluol-disulpho acid—

$$C_6H_3\left\{\begin{matrix}CH_3\\SO_3\\SO_3\end{matrix}\right\}Ba+3\tfrac{1}{2}H_2O.$$

The free acid is a solid substance, readily decomposable at 100°. In addition to several salts of this acid, the following derivatives thereof are described:—Isorcin; isoxylidinic acid.

Action of Fusing Caustic Potassa upon Benzoic Acid.—L. Barth.—This lengthy memoir treats on the products obtained by the fusion together of benzoic acid and solid caustic potassa, the operation being conducted in a silver vessel. Para-oxybenzoic acid is the main product; further, an acid, $C_{14}H_{12}O_7$; and an amorphous, yellow-coloured, resinous body, insoluble in water.

Sulpho-Para-Oxybenzoic Acid.—R. Kölle.—The preparation of this acid is described at length. The pure substance is a solid deliquescent body, soluble in alcohol, but insoluble in ether; fusing-point, below 100°. Among the salts, the potassa salt is described at length; it is crystalline; its formula is $C_7H_3K_3SO_6+2H_2O$.

Researches on Kynurenic Acids and Kynurin, the Product of Decomposition of these Acids.—Drs. O. Schmiedelberg and O. Schultzen.—The name of this acid is derived from κυνος, "a dog," the acid being met with in dogs' urine, and obtained from it by a rather difficult process of operation. Pure kyanurenic acid is a solid, crystalline, needle-shaped body, insoluble in water, and also in water acidulated with either hydrochloric or nitric acids, but somewhat soluble in these acids when concentrated, and also pretty soluble in boiling alcohol; the acid fuses at 266°, but is then somewhat decomposed, much gas being evolved; with baryta, kyanurenic acid forms a rather difficultly soluble salt. The formula of the free acid is—

$$C_{20}H_{14}N_2O_6+2HO;$$

that of the baryta salt is $C_{20}H_{14}N_2O_6Ba+3H_2O$. Kynurin is the substance which is obtained by fusing the kynurenic acid at 265° on an oil-bath; much carbonic acid is given off, and, after purifying, a solid, crystalline, neutral body is obtained, slightly soluble in alcohol, and fusing at 201°; formula, $C_{18}H_{14}N_2O_2$.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, June 16, 1872.

Studies on Dynamometers.—C. Mène.—The continuation of an essay on this subject, illustrated with woodcuts.

Preparation of Nitrite of Amylen for Pharmaceutical Use.—C. Mène.—From the crude alcohol of commerce, this substance may be prepared in the following manner:—The crude alcohol, which is readily obtained in France, is first washed with a concentrated aqueous solution of common salt, and then with a large quantity of water, after which the remainder is submitted to distillation in a retort, to which a thermometer is fitted; that which distils over below 125° is set aside as unsuitable, but the distillate from 125° to 140° is kept and rectified at 132°. The amylic alcohol thus obtained is poured into another retort, fitted with a safety-tube; some clean copper wire having been put into the retort, a mixture, of about one-tenth each of the bulk of the alcohol, of sulphuric and nitric acids is then added. The temperature is gently raised to 65°; nitric acid is again added to the liquid in the retort, and the operation of distillation re-commenced until red vapours appear; the product is then washed with caustic soda solution, and re-distilled over carbonate of potassa. The portion which distils over between 95° and 100° is nitrite of amylen, sufficiently pure for pharmaceutical use. Amylic alcohol may be obtained in this country from manufacturing chemists, thus saving the trouble of separating it from crude alcohol.

La Revue Scientifique de la France et de l'Etranger, September 7, 1872.

This number contains no original papers relating to chemistry or collateral subjects.

September 21, 1872.

The contents of this number are devoted to the record of the proceedings of the Bordeaux meeting of the French Association for the Advancement of Sciences. The President of the Chemical Section is Professor Balard; Honorary Presidents, Drs. Stas and Von Baumhauer; Vice-President, Dr. Wurtz; Secretary, M. Lecoq de Boisbaudran. From the condensed report of the proceedings we glean the following:—Prof. Berthelot gave a concise, yet extensive, *resumé* of his researches on the condition of bodies when in solution, pointing out the important bearing of the results obtained by him as regards its application to the study of wines, mineral waters, blood, milk, urine, &c., and molecular mechanics. M. Jungfleisch, after briefly alluding to Pasteur's researches on the synthesis of racemic acid, and also to those of Dessaigne, Perkins, and Duppa, stated that all substances derived from tartaric acid by elimination of water regenerate, by absorption of that fluid, tartaric acid, which turns the plane of polarisation to the right, but, as soon as the tartaric acid is submitted, in the presence of water, to a high temperature, this does not further obtain; at 175°, a considerable portion of racemic acid is formed, while the mother-liquor from that acid contains a quantity of inactive (optically) tartaric acid; these facts are of general application. Anhydrous camphoric acid regenerates the acid from which it was obtained; when, however, camphoric acid is heated in the presence of water, other products, differing from anhydrous camphoric acid, are formed. Dr. Schützenberger gave a brief account of his researches on platinum compounds; by causing oxide of carbon to react upon bichloride of platinum, three different products are obtained, according to the conditions under which the operation is conducted, viz., $COPtCl_2$, $C_2O_2PtCl_2$, and a compound of these two. Perchloride of phosphorus attacks platinum at 250°, and gives an analogous compound, $PhCl_3PtCl_2$, which crystallises, and yields in its turn, with $PhCl_3$, another canary-coloured product, $(PhCl_3)_2PtCl_2$; in contact with water, the product $PhCl_3PtCl_2$ is converted into a hydrate—

$$Ph(OH)_3PtCl_2,$$

a veritable acid, which yields, with lead, a compound—

$$Ph(OPb)_3PtCl_2 + PbO,$$

which is a detonating salt. With alcohol, $PhCl_3PtCl_2$ yields a crystalline compound, fusing at 83°, and yielding chloride of ethyl when heated to 180°, leaving a compound, $Ph(C_2H_5O)_3PtCl_2$; by further heating, this compound is converted into chlorhydric acid, ethyline, polyphosphoric acid, and platinum. The compounds of ammonia and $Ph(C_2H_5O)_3PtCl$, and derivatives therefrom, are next alluded to, and, lastly, the series of the compound $(PhCl_3)_2PtCl_2$. M. Henninger gave a brief account of his (and Vogt's) researches on the synthesis of orcin. Filhol discussed the condition in which sulphur is met with in the mineral waters of the Pyrenees. In the Section for Civil and Military Engineering, M. E. Lemoine read a lengthy paper on the repartition of the pressure in a network of gas-mains and on the best means to regulate that pressure. Among the papers read in the Mathematical Section, we notice a memoir by M. Saint-Loup, on the elastic force of vapours in relation to temperature. M. Hureau de Villeneuve explained the construction and management of a new kind of steam-boiler, which is heated by petroleum, and appears to possess great advantages, especially as regards prevention of loss of heat. In the Zoological Section, important and practically available communications are made on ostreiculture, especially in reference to the labours of MM. Michelet and Austchysky at the Bay of Arcachon, where oysters are now cultivated on a large scale. To this number is added the list of the names of all the members of the Association.

Polytechnisches Journal von Dr. E. M. Dingler, second number for August, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Application of the Water Air-Pump to Evaporation, Distillation, Filtration, &c., in Vacuum.—F. A. Wolff and Sons.—This paper, illustrated by engravings, contains the record of a series of technical experiments made with a contrivance somewhat like Bunsen's air-pump (described by Winkler in Dingler's *Polytech. Journ.*, vol. cxcv., p. 34, 1870). It appears that many of the industrial operations may be more rapidly and advantageously conducted by the aid of a vacuum.

Basic Carbonate of Lime in Hydraulic Cements.—A. R. Schulatschenko.—The contents of this exhaustive monograph, elucidated by a large number of analyses of limestones and cements, may be *resumed* as follows:—The formation of basic carbonate of lime as a consequence of the incomplete burning of the limestone is doubtful; the incomplete burning of aluminous limestones *(thonhaltige kalksteine)* rarely yields good results. Considering the excellent quality of the Roché cement, the author thinks that the Wolchowo (Russia) aluminous limestone will yield a cement of better quality.

Studies for Establishing a Scientifically-Arranged Tanning Method.—A. Reimer.—The continuation of an exhaustive essay, this portion being divided into the following sections:—Skin (hide) with alum and common salt; mixture of equal parts of the two last-named salts; sulphate of alumina only; acetate of alumina.

Test for the Adulteration of Beer with Caramel.—Dr. R. Schuster.—The author states that when beer is mixed with a solution of tannic acid, and thoroughly shaken, it is discoloured when malt only has been used, but, when caramel has been added, the colour remains unaltered.

Estimation of Acetic Acid in Wine.—E. Kissel.—The wine is first neutralised with baryta; next, the alcohol is distilled off; and then phosphoric acid is added, and the liquid re-distilled; the distillate contains the acetic acid.

Bayerisches Industrie und Gewerbe-Blatt, August, 1872.

Aluminium-Plating.—Dr. C. Winkler.—This memoir contains a discussion on the methods and practicability of coating other metals with aluminium. From the author's researches on this subject, it appears that neither galvanoplastically, nor also by the well-known method of plating, the object in view can be obtained.

Methods of Detecting and Quantitatively Estimating Paraffin in Stearine Candles.—M. Hock.—After reviewing the various methods employed for this purpose, the author states that it is best to saponify the stearine (really stearic acid) with moderately strong caustic potassa, to convert the soap thus obtained into a soda-soap, by means of chloride of sodium, and to treat the soda-soap on a filter, first with cold water, and next with some dilute alcohol; the soap is dissolved, and the paraffin set free; the filter is then dried at a temperature of about 35°, after which the paraffin is dissolved in ether, and this solution evaporated, and the residue weighed. This method has been tried by the author with mixtures of known quantities of stearine and paraffin, and found to answer well.

French Putty.—Ruban.—7 pounds of linseed oil are boiled with 4 pounds of brown umber for about two hours; 62 grms. of chips of wax are then added to the oil. After having been removed from the fire, a mixture of 5½ pounds of chalk and 11 pounds of dry white-lead is added to the oil. This putty is stated to be very durable, and to adhere strongly to wood which has not been painted.

Very Durable Crucibles for Smelting Steel and other Metals.—Dr. G. Feichtinger.—These crucibles are made with the following mixture:—Ground-up and lixiviated porcelain mass, 10 parts; graphite, 10 parts; asbestos (cut up into threads of some 3 m.m. length), 15 parts; powdered quartz, 3 parts; fire-clay, 22 parts.

Archives Neerlandaises des Sciences Exactes et Naturelles, Vol. vii., No. 2, 1872.

The following original papers and memoirs relating to chemistry and collateral subjects are published in this number:—

Influence which the Temperature Exerts upon the Rotatory Power of Tartaric Acid and Tartrates.—F. W. Krecke.—This lengthy essay, illustrated by woodcuts, is divided into the following sections:—Introduction, containing a concise review of the labours of Biot and others, and of the general laws of rotation of organic bodies; method of observation; influence of temperature upon the specific rotatory power of tartaric acid; influence of the temperature upon the specific rotatory power of the tartrates, viz., of potassa, soda, ammonia, sal-seignette, potassio-tartrate of antimony; conclusions. The paper contains a series of tables exhibiting results of experiments.

Determination of the Temperatures in the Experiments of M. V. Regnault on the Elastic Force of Aqueous Vapour and Steam.—J. Bosscha, jun.—This essay, elucidated by a series of tables exhibiting results of experiments, is written more particularly to show certain errors in Regnault's work.

Meteorite of Knyahinya, in the Comitat of Unghvär (Hungary).—E. H. von Baumhauer.—This exhaustive memoir contains, in the first place, a detailed account of the phenomena attending the fall of this meteorite on June 9th, 1866, as witnessed by several persons whose evidence was taken in writing by the late Chevalier W. von Haidinger. The second portion is devoted to the chemical analysis and method of investigation applied. The composition of this stone is, in 100 parts:—Nickeliferous iron, 5·0; sulphuret of iron, 2·2; chrome iron, 0·8; olivine, 39·9; insoluble bisilicate, 52·1.

Meteorite de l'Aigle, Departément de l'Orne, France.—E. H. von Baumhauer.—This meteorite fell on April 26th, 1803. A record is given of the analysis of this stone, which was found to contain, in 100 parts—Nickeliferous iron, 8·0; sulphuret of iron, 1·8; chrome iron, 0·6; sulphate of lime, traces; olivine, 45·3; bisilicate, 44·3.

Although not strictly relating to chemistry, we quote the titles o the following essays:—

Poisoned Arrows of Africa.—A. W. M. van Hasselt.—The results of physiologico-toxicological experiments made with, and the botanical origin of, the arrow-poison used in Africa.

General Report on the Observations of the Total Eclipse of the Sun of December 12th, 1871, drawn up from the Reports of various observers in the Island of Java by Dr. Oudemans, Chief Engineer of the Geographic Bureau at Batavia.

Artificial Production of some of the Principal Formations of Organic Calcareous Origin.—P. Harting.—This paper, illustrated by woodcuts, records the author's ingenious investigations, by which he has artificially produced calcareous forms exactly like those made by the lower orders of animal life.

Vol. vii., No. 3, 1872.

This number contains, in addition to several original papers and memoirs relating to mathematics and natural history, the following original papers relating to chemistry:—

The Chemical Process (Chimisme) of Respiration Considered as a Phenomenon of Dissociation.—F. C. Donders.—Reserved for translation.

Mannite and Nitro-Mannite Considered in their Action upon Polarised Light.—F. W. Krecke.—This essay is elucidated by a series of tables. The author's conclusions are—(1) Mannite which is optically-inactive is converted, by the action of nitro-sulphuric acids, into optically-active nitro-mannite; (2) optically-active nitro-mannite is converted again into optically-inactive mannite by sulphuret of ammonium; (3) optically-active dextrose is converted, under the influence of sodium amalgam or of platinised magnesium *(magnesium platine)*, into optically-inactive mannite; (4) the optically-inactive mannite thus obtained is converted by nitro-sulphuric acids into optically-active nitro-mannite; (5) slight molecular changes of bodies are sufficient to convert them from optically-active into optically-inactive substances and *vice versâ*.

Slow Combustion.—P. J. van Kerckhoff.—Reserved for translation.

Primary Normal Hexylic Alcohol Contained in the Essence of the Heracleum Giganteum.—A. P. N. Franchimont and Th. Zincke.—An abstract of this extensive memoir was published in another periodical, and quoted in the Chemical News (vol. xxv. p. 57).

Pharmaceutische Zeitschrift für Russland, No. 10, 1872.

The only original paper published in this number is the continuation and conclusion of the memoir—

Relation of Modern Chemistry to Metallurgy.—Dr. C. Winkler

No. 11, 1872.

This number contains no original papers relating to chemistry, but we notice the following memoir:—

Description of some Pharmacognostically Important Objects in Use in Central Asia.—R. Palm.—The author gives an accoun of the following substances:—Schörum-Dorü is a kind of sea-weed obtained from the salt-lakes of Thibet; the chemical investigation o this substance proved it to contain about 1 per cent of iodine, combined with bases. When boiled with water, this sea-weed (of which a lengthy botanico-pharmacognostical description is given) yields a jelly no

dissimilar to that obtainable by the same treatment from Irish moss (*Lichen Carraghen*). The ash contains sodium, magnesium, alumina, calcium, potassium, oxide of iron, chlorine, iodine, sulphuric acid, silica, phosphoric acid, and carbonic acid; according to the author, no plant has yet been found to contain so large a quantity of iodine as this sea-weed. Sirauwant is a kind of tubercle, which contains 47·57 per cent of starch, 2·88 per cent of salts (ash), and also a peculiar principle, which somewhat resembles emetin, but of which, in consequence of insufficient material, no further investigation could be made. Bucharian nutgalls, locally known as Busgunsch, contain 43·10 per cent of tannic acid, 3·03 per cent of a green waxy matter, and 16·0 per cent of cellulose.

Chemisches Centralblatt, No. 35, 1872.

This number contains the following original communications:—

Precipitate Produced in Beer by the Addition of a Solution of Carbonate of Potassa.—A. Metz.—It appears that a concentrated solution of the salt alluded to produces in beer a slight, but distinct, crystalline precipitate (10 grms. of the salt to 1 litre of beer), which consists of hydrated phosphate of potassa and magnesia—

$$KO.2MgO.PO_5+12HO.$$

Preparation of Artificial Fuel from Small Coal and Small (Pulverulent) Anthracite.—F. Loiseau.—By the addition of about 5 per cent of clay to the coaly matter, the author forms it, by strong pressure, into the shape of large-sized bricks, which are next placed in a solution of resin in benzin (benzoline), and then dried; by this process, the artificial fuel is rendered impervious to water, and more readily combustible.

NOTES AND QUERIES.

Gum Copal.—(Reply to C. T. Kingzett).—This resin is not soluble in alcohol, which is the ordinary solvent of resins, but, after having been first softened by pure ether, which renders copal gelatinous, the resin is soluble in alcobol; chloroform dissolves copal readily, but the best solvent is the empyreumatic oil obtained by the dry distillation of caoutchouc, and also the empyreumatic oil obtained when copal is heated above its melting-point, which is between 180° and 340°. Strong liquid ammonia renders copal gelatinous, and, when heated with a concentrated aqueous solution of caustic potassa, it is dissolved. It should be remembered that, under the name of copal), resins of different origin are imported from different countries, and the properties of these differ greatly. By exposure to air, after having been first pulverised, copal absorbs oxygen, and becomes more readily soluble in the solvents mentioned, as well as in oils of turpentine and rosemary.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1421. J. Robey, Manchester, "A new or improved filtering medium suitable also as a disinfectant and deodoriser."—Petition recorded May 10, 1872.

2115. J. G. Tongue, Southampton Buildings, Chancery Lane, "Improvements in the production of fertilising materials or manures, and in the means and apparatus employed in the manufacture of the same, partly applicable to other purposes."—A communication from H. A. Hogel, New York, and H. B. Bigelow, New Haven, Conn., U.S.A.—Petition recorded July 13, 1872.

2337. T. Richardson, J. W. Richardson, and A. Spencer, West Hartlepool, Durham, "Improvements in the manufacture of iron and steel, and of revolving puddling furnaces or converters, and apparatus to be employed therein."—Petition recorded August 6, 1872.

2396. R. Hadfield, Sheffield, Yorks, "An improved process for making steel wheels, and for combining steel or wrought-iron with cast-iron or other similar metal."—Petition recorded August 12, 1872.

2429. T. J. Denne and A. Heutschel, Mile End, Middlesex, "Improved combinations of ingredients for treating, preparing, stiffening, and thickening raw, felted, spun, and woven fibres and fabrics, also for use in dyeing and printing such fabrics and fibres."—Petition recorded August 15, 1872.

2506. E. A. Cooke, Viewville House, Midlothian, N.B., "Improvements in treating animal charcoal."

2510. W. Vincent, Arborfield, Berks, "Improvements in apparatus for manufacturing gas."—Petitions recorded August 23, 1872.

2528. J. F. Parker and A. Wade, Birmingham, "Improvements in the manufacture from coal and petroleum of hydrocarbon gas, or gas for illuminating and heating."

2538. H. Y. D. Scott, C.B., Ealing, Middlesex, "Improvements in the treatment of sewage, and in the preparation of manures therefrom."—Petitions recorded August 26, 1872.

2542. W. W. Box, Crayford, Kent, "Improvements in apparatus used in the manulacture of gas."—Petition recorded August 27, 1872.

2569. B. W. Gerland, Ph.D., Macclesfield, Cheshire, and E. Johnson, Dartmouth Park, near Sydenham, Kent, "Improvements in the manufacture of sanitary charcoal and the application thereof to the treatment of sewage."

2573. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the manufacture of hydrochloric acid, and in apparatus employed therein."—Petitions recorded August 29, 1872.

2617. F. C. Danvers, Ealing, Middlesex, "Improvements in the manufacture of artificial fuel."

2619. F. R. H. Protheroe, Lydney, Gloucestershire, "Improvements in the manufacture of paper."—Petitions recorded September 3, 1872.

NOTICES TO PROCEED.

1293. C. Duff, Wandsworth Road, Surrey, "Improvements in the treatment of fibrous substances to be used in the manufacture of pulp for paper, and for conversion into spun and textile fabrics."—Petition recorded April 30, 1872.

1307. L. Bradley. Rotterdam, Holland, "Improvements in the manufacture of cement."—Petition recorded May 1, 1872.

1375. C. Viel, Compton Street, Brunswick Square, Middlesex. "A new washing fluid for obliterating marks or stains in white linen."—Petition recorded May 6, 1872.

1415. B. French, Rochester, New York, U.S.A., "Improvements in lubricating compounds."—Petition recorded May 10, 1872.

1432. J. Sutherland, Glasgow, N.B., "Improvements in furnaces for puddling and re-heating iron."—Petition recorded May 11, 1872.

1468. J. Spratt, Camberwell, Surrey, "A new or improved food for cats."—Petition recorded May 14, 1872.

2426. D. Joy, Saltburn-by-the-Sea, Yorkshire, "Improvements in the means and apparatus for purifying iron, and for removing the slag and other impurities from blast and other furnaces."—Petition recorded August 14, 1872.

2572. W. R. Lake, Southampton Buildings, London, "Improved compounds, chiefly designed for coating ships' bottoms."—A communication from J. H. Bloodgood, New York, U.S.A.—Petition recorded August 29, 1872.

PATENTS SEALED.

766. S. J. Beaman and J. Onions, Wednesbury, Staffordshire, "An improved puddling furnace."—Dated March 14, 1872.

794. J. Russell, Bonnyfield, and W. R. Hutton, Stirling, N.B., "Improvements in obtaining zinc."—Dated March 15, 1872.

826. W. Garey, Aberdeen, N.B., "Improvements in preparing paper for photographic purposes.

836. D. Nicoll, London, "Improvements in compounds for, and in the treatment of, fabrics to render the same waterproof and uninflammable."—Dated March 19, 1872.

971. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in liqueurs or cordials and other beverages, and in apparatus to be employed in their manufacture."—A communication from F. A. Joannon, Paris, France.—Dated April 3, 1872.

1051. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of animal and vegetable substances."—A communication from W. Adamson, Philadelphia, Penn., U.S.A.—Dated April 9, 1872.

1376. D. G. Fitzgerald, North Brixton, Surrey, and B. C. Molloy, Temple, Middlesex, "Improvements in treating compound substances by the agency of electricity, and thereby decomposing them or resolving them into their components, and in apparatus employed therein." Dated May 6, 1872.

1516. J. Baird, Glasgow, N.B., "Improvements in treating oils for lubricating and other purposes."—Dated May 18, 1872.

2153. W. Paterson. W. A. Sanderson, R. Sanderson, and J. Sanderson, Galashiels, "Improvements in the treatment of wool in process of manufacture and in the preparation of materials therefor." Dated July 18, 1872.

PATENTS GRANTED IN BRITISH COLONIES AND DEPENDENCIES.

NEW SOUTH WALES.

286. F. Sacc, M.D., Neufchatel, Switzerland, "Improvements in the preservation of fresh meat and vegetables, and in the preparation of extract of meat."—Dated May 10, 1872.

288. A. Noble, Hamburg, "Improvements in the manufacture and use of an explosive compound."

289. R. Bright, Melbourne, Victoria, "Improvements in the construction of furnaces for smelting ores, and for an improved method of smelting antimony and other ores."—Dated May 30, 1872.

VICTORIA.

Application for Patent.

1638. L. Hesse, Melbourne, "Improvements in the manufacture of albumen from blood."—Dated May 31, 1872.

Patents Granted.

1589. A. Morgan, Footscray, "Improvements in the manufacture of cement."—Dated December 11, 1871.

1591. L. Y. Ball, East Melbourne, "Improvements in the curing of meat."—Dated December 20, 1871.

1628. J. Watteau, Antwerp, Belgium, "An improved depilatory composition for hides and skins.—Dated May 6, 1872.

TO CORRESPONDENTS.

H. Hargreaves.—Write to the office, Rue de Buci 12, Paris.

J. F.—Slatter's "Analytical Chemistry," or Noad's "Chemical Analysis."

St. Thomas.—Dr. Duflos's work is not published in English.

J. F. Armstrong.—You can obtain American and Saxony Patents at the Patent Office, Southampton Buildings, Chancery Lane.

Birkbeck Institution.—Since the publication of our Student's Number, it has been decided to commence the Chemistry Classes on Tuesday evenings at 7.30 p.m., instead of at 8 p.m.

THE CHEMICAL NEWS.

VOL. XXVI. No. 671.

ON THE

OCCURRENCE IN RECENT PINE TIMBER OF FICHTELITE, A HYDROCARBON HITHERTO ONLY KNOWN IN A FOSSIL STATE.

By J. W. MALLET, Ph.D., M.D.,
Professor of Pure and Applied Chemistry, University of Virginia.

SOME nearly colourless crystalline crusts found in clefts between the annual rings of growth of a log of long-leafed pine (*Pinus Australis*) in Alabama were found to dissolve in boiling alcohol (more easily in ether), and, on cooling, to crystallise in monoclinic forms with greater distinctness. A specimen was exhibited of this material purified by two or three re-crystallisations ; it had been found to agree perfectly in physical and chemical properties with the fichtelite of Bromeis and Clark, and on analysis yielded—

Carbon	87·82
Hydrogen	11·91
	99·73

agreeing with the formula $x(C_5H_8)$. The fusing-point was found = 45° C.

ADJUSTMENT OF VOLUMETRIC TEST-SOLUTIONS.

By F. MAXWELL LYTE, F.C.S.

I BEG to suggest a mode of adjusting the strength of volumetric test-solutions, which offers at least the advantage of dispensing with tedious measurements, and offers a means of a more rapid adjustment where large bulks of liquid are to be dealt with. I cannot do better than simply illustrate my plan, without further explanation, by a practical example.

Let us suppose a deci-normal test-solution of oxalic acid to have been made, and, taking this as a basis, that it is desired to manufacture a solution of soda exactly to correspond with the deci-normal acid. The usual method employed is to make a soda solution more concentrated than requisite, to try how much of this liquid corresponds to a measured volume of the deci-normal acid, and to calculate thence the percentage volumes of soda solution and water which have to be mixed to bring the alkaline solution to deci-normal strength. The adjustment is then obliged to be made by actual, and for large quantities tedious, measurements.

My mode of proceeding is as follows:—Suppose a large jar of soda solution is to be made. I make, first of all, say, half the jar full of solution, which I guess will be nearly double the required strength, over or under the mark, it matters but little which, and I titrate to find out how much of the solution is equal to a given volume of deci-normal acid. I now add a measured quantity, say 200, 500, or 1000 c.c. of water, as the case may be, and I titrate again. This time I shall have brought my alkaline solution somewhat nearer to the deci-normal standard, and, without knowing the bulk of the original alkaline solution, I am able to calculate the percentage effect of my addition of water, and from this, by a simple proportion, I can easily calculate how much water I ought to have added in order to render the alkaline solution strictly deci-normal.

A jar of about 45 to 50 litres capacity contained soda solution to be adjusted ; 88 c.c. of this solution were found to correspond to 100 c.c. of deci-normal acid. 500 c.c. of water were added, and, on titration, it was found that 93 c.c. now corresponded to 100 c.c. of acid. The liquid, then, originally required to be lowered in strength 12 per cent, and the addition of the 500 c.c. of water lowered it 5 per cent ; if, then, instead of 500 c.c., we had added 1200 c.c., we should have reduced the solution to deci-normal strength ; therefore, to effect this, all we have to do now is to add 700 c.c. more of water, and the liquid is adjusted thus without further measurement or manipulation. Of course, if the alkaline solution had been too weak originally, instead of being too strong, the water added might have been substituted by a strong solution of soda, and the adjustment proceeded with on the same basis.

Paris, Sept. 19, 1872.

ON THE

PRESENCE OF GOLD IN SEA-WATER.

By E SONSTADT.

I HAVE used three entirely different methods for the detection of gold in sea-water, but all the methods were applied to the water itself, not to the residue left on evaporation. The experiments have been made upon specimens collected at different times from different parts of Ramsey Bay, Isle of Man, and the results obtained from the different specimens have been in entire accordance. The proportion of gold contained in sea-water (certainly less than one grain in the ton) is much too small to admit of separation, or even detection, by the usual tests applied in the usual manner. Besides the difficulty of detection arising from the small proportion of gold present, there is another difficulty of a graver kind, due to a continuous re-solution of the gold after it has been separated in the metallic state. This re-solution is owing to the separation of iodine under the influence of reducing agents upon the iodate of calcium, which, in a paper published in the CHEMICAL NEWS, I have shown to exist in sea-water. Even if the reducing agent is added in very large excess, oxidation takes place so rapidly under the continuous re-forming power of iodate of calcium, that, sooner or later, according to the excess of reducing agent used, the stage arrives at which iodine is set free, and the suspended gold is re-dissolved.

I. The first method I shall describe of detecting gold in sea-water may be practised upon so small a quantity of water as 150 or 200 c.c. Two or three decigrammes of pure ferrous sulphate are dissolved in the water, which is acidulated by two or three drops of hydrochloric acid. The solution is heated in a *chemically clean* and well-glazed porcelain dish, over a small flame, so managed that the flame may touch the under part of the dish without causing ebullition. Under these circumstances a lustrous film of ferric oxide forms in the dish, commencing from the portion directly heated by the flame. The heat is continued, without boiling, until the sea-water is evaporated to about half, or so long as the film increases in extent and in lustre. The liquid is then poured off, the strongly adherent film is rinsed with a little water, and then about 50 c.c. of strong chlorine water is allowed to stand in the dish for an hour or two, after which it is slowly evaporated down (over the film) to a few drops, a drop of dilute hydrochloric acid being added towards the end of the evaporation. The liquid, which should be nearly colourless, is then poured into a test-glass containing a few drops of solution of stannous chloride, when, after a few minutes, the liquid takes a bluish or purplish tint, which may be exactly matched by a drop or

* Read before the British Association, Brighton Meeting, Section B.

two of a suitably diluted solution of gold added to a corresponding portion of tin-salt in another glass. The reaction may, of course, be made more striking by taking for the experiment a larger quantity of sea-water, although the reaction obtainable from the quantity indicated is quite definite. I have repeated this experiment many times, upon different specimens of sea-water, and always with the same result when a *film* was obtained on evaporation. But the formation of this film depends upon the iron being in a particular degree of oxidation, and I have sometimes failed to obtain it. The best way is, after adding the ferrous sulphate and hydrochloric acid to the sea-water, to leave it exposed to the air for a few hours, or over night, before heating the liquid to obtain the film. Corresponding experiments were made, in the same vessels and with the same reagents, upon simple water, and upon water containing chloride of sodium and alkali sulphates in solution, but the films obtained, when treated as described, never gave the slightest colouration with solution of stannous chloride. The chlorine solution off the sea-water films may be dried up in a porcelain crucible with precipitated lead, and gold beads obtained by cupellation, after fusing the lead into a button with borax; but for this experiment at least half a litre of sea-water should be taken, and even then the bead obtained is not ponderable.

II. From half a litre to a litre of sea-water should be taken for the experiment now to be described. As much solution of pure chloride of barium is added to the water as will give about a grain of precipitate. A day or two should be allowed for the precipitate to settle. The precipitate is collected, dried, mixed with borax and lead, and the button of lead obtained before the blowpipe on charcoal is cupelled. The bead obtained is yellowish white, of the same colour as an alloy of 60 parts gold to 40 of silver, or thereabouts. For confirmation of the presence of gold the bead may be dissolved, in a very small test-tube, in a few drops of aqua regia, which is then evaporated, at a gentle heat, nearly to dryness. A few drops of pure hydrochloric acid are added, and the solution again evaporated, to destroy the excess of nitric acid. The solution is evaporated very nearly, but not quite, to dryness, a few drops of water are added, and the mixture warmed, and when the chloride of silver is settled a drop of solution of stannous chloride is allowed to fall down the side of the tube into the liquid, when the characteristic gold reaction is obtained. This experiment is delicate, and requires some care. For the laboratory method I. is much the easier and quicker of the two; but it is conceivable that method II. might be practically applied to the exploitation of the gold in sea-water, which might be received at high water in large tanks, and emptied at low water, the chloride of barium solution being meanwhile used, and the precipitate left in the tank taken out from time to time.*

III. The method that I give last was that whereby I first obtained evidence of the presence of gold in sea-water; but this method is open to objection, as being more troublesome than the preceding methods. To at least a litre of sea-water, contained in a stoppered bottle, a few grammes of ferrous sulphate are added, and after two or three days some solution of stannous chloride, followed by solution of mercuric chloride, taking care that the latter is added in such proportion that the water is still capable of separating mercury from more solution of mercuric chloride. Neither the precipitates caused by ferrous sulphate nor by stannous chloride, in sea-water, carry down with them more than a small fraction of the gold present in sea-water; but when the mercuric chloride is added to the water already containing stannous chloride, mercury is precipitated in the liquid, and, as it subsides, carries down with it both gold and silver as an amalgam. The ferrous sulphate may be dispensed with, but then a larger proportion of stannous chloride must be used, and this oxidises so rapidly in sea-water that there is danger of re-solution of its precipitated gold by iodine, as mentioned at the beginning of this paper. The precipitate, if tin and mercury salts only have been used, may be ignited, and assayed in the usual way, and the bead obtained treated as described under II. The assay is, however, troublesome, owing to the large proportion of tin oxide to be treated. But if the precipitate contains iron oxide, the usual method of assay will fail, because during the process of smelting, iron oxide is reduced to the metallic state, even at a low red heat; and the spongy iron locks up the gold and silver away from the lead. Hence, in assaying substances containing much iron oxides, it is necessary, as far as possible, to prevent reduction of the iron by using only borax as the flux, and that in proportion large enough to hold the iron oxide in complete solution. The oxidating and not the reducing flame of the blowpipe must be used upon the assay.*

The reagents used in all these experiments were not only severely tested separately as to freedom from the precious metals, but in each set of experiments on the sea-water, entirely correspondent experiments were made upon rain-water, always with negative results.

I have referred to the solvent action of very dilute solutions of iodine upon gold. The following experiment illustrates this action. A little precipitated gold was added to strong hydriodic acid, slightly coloured by iodine but otherwise quite pure. The acid quickly became opaque. A drop or two of the solution added to a rather strong solution of stannous chloride in a test-glass immediately caused precipitation of purple-of-cassius, the supernatant liquid being colourless, and remaining so on addition of more tin solution. After a few days' exposure, the liquid smelt of iodine; and then addition of more tin salt caused instant separation of purple precipitate;—proving that the iodine liberated had dissolved some of the precipitated gold. After another day or two of exposure, gold was again in solution, and was precipitated by further addition of tin salt, and this was repeated several times; and evidently the re-solution of the gold would have gone on indefinitely after successive precipitations.

As gold is very readily reduced from highly dilute solution by the action of organic matter and of sun-light, it was important to ascertain wherein sea-water differed from ordinary water in its action on gold, or, rather, wherein lay its power to retain gold in solution in presence of organic matter. This power was proved to reside in the iodate of calcium present in sea-water by the follow-

* The precipitation of gold from sea-water by chloride of barium seems scarcely explicable, unless by supposing the gold to be present in the sea-water as an aurate, so as to be thrown down as aurate of barium. This view has much in its favour, and is greatly supported by the fact that if oxalic acid is added to sea-water some time before the addition of chloride of barium, it is scarcely possible to detect gold in the precipitate formed. And this is easily to be understood, since oxalic acid reduces all gold salts; and in so dilute a liquid—that is, a liquid in which any gold reduced is so finely divided—any precipitation of such gold, unless under the conditions described in the methods I. and III., could not be expected to take place.

* Some years ago, having occasion to make a great number of assays for the precious metals in specimens taken from the mountains of Reumammawr, in North Wales, I was greatly puzzled by the conflicting results obtained with the same reagents, but under different modes of working. Specimens smelted before the blowpipe always gave much higher results than those that were treated in crucibles. For in the former case I used only borax as a flux, and in the latter, to make the mixture more fusible, and also to ensure a good button of lead, I used, besides borax, carbonate of sodium or of potassium and charcoal powder. Nevertheless, even in the latter case, beads of auriferous silver containing also platinum were always obtained; for the proportion of iron oxides contained in the mineral was not large enough entirely to prevent the solvent action of the lead upon the precious metals. But more recently on assaying a series of red hæmatite ores found in the Isle of Man, I obtained from some specimens treated before the blowpipe, with a good proportion of borax, as much as 16 ozs. silver to the ton; while the same specimens smelted in crucibles as described, left a spongy mass of iron, and the lead button contained *no silver*. I repeated the experiments often enough to leave no doubt respecting the cause of these discrepancies being that referred to in the text. I also sent samples of these ores, containing from 4 to 16 ozs. silver to the ton, to eminent assayers, who informed me that they contained *no trace* of the precious metal.

ing direct experiment.* A drop of gold solution was added to about 400 c.c. of rain-water, and the solution was divided into two equal parts, to one of which a tenth of its bulk of solution of iodate of calcium containing 1 part iodate to 1000 of water was added, A drop of the same gold solution was added to 400 c.c. sea-water, and another drop to a corresponding quantity of iodate of calcium solution. The beakers containing the four solutions were placed, uncovered, in sun-light. All the solutions except that of sea-water became perceptibly coloured after a few hours, and next day were distinctly ruby-coloured, the sea-water remaining colourless. After another day or two, however, all had become nearly colourless, except the pure solution of gold, which remained permanently coloured. The disappearance of the colouration could only arise from solution of the precipitated gold, since subsidence was out of the question. Ruby liquids so dilute as these I have found not to lose colour by subsidence for months. Many similar experiments have been made under varied circumstances, all showing that solution of iodate of calcium has absolutely no solvent action on gold, nor even the power to prevent its reduction from solution. But so soon as the iodate itself undergoes partial decomposition under the influence of putrescible matter, iodine is liberated, and gold, if present, is dissolved.

REPORT UPON THE CHEMICAL AND ALLIED PRODUCTS SHOWN IN THE DUBLIN EXHIBITION.

The Dublin Exhibition so far has been a success, mainly owing to the fine Art Collection of pictures, and what is termed the Loan Collection. There is not much novelty as regards the chemical and other products shown, but what is there is excellent in quality. They are all British and Irish exhibitions, with the addition of a few Colonial ones. It is generally supposed that the Exhibition will close at the end of November, although this has not been officially announced. The following are the Exhibitors who will probably interest our readers.

Messrs. J. C. and J. Field, London.—This celebrated firm exhibits many articles of interest, particularly in the candle line. They are also probably the exhibitors of the greatest novelty in this branch of manufacture, namely the ozokerite candles. This fossil resin was first mentioned by Meyer, who discovered it in Moldavia in connection with coal and rock-salt. The source of the candles made by Messrs. Field is a product from the Carpathian Mountians, which seems to have been first submitted by Dr. Letheby to the notice of that firm in 1868. They seem to have surmounted all the practical difficulties incident to the purification of this unpromising brown substance, and have produced the most beautiful candles in appearance which have yet been made. The characteristics of the crude ozokerite which is shown is as follows:—Its colour is brown, with a wax-like lustre when burning. Its odour is of the aromatic hydrocarbons. It is said to have a sp. gr. of 0·94, and melts 66° C. It distils without decomposition, and is not altered by strong acids. It slightly differs in chemical and physical properties according to the source from whence it is derived, and the above description applies more to the specimens of crude ozokerite shown by Messrs. Field and Co., and examined by the writer. It is, when purified, a variety of paraffine having the following composition:—

Carbon	85·75
Hydrogen .. .. .. : ..	15·15
	100·9

Nothing can exceed the beauty of the candles as made by Messrs. Field and Co. from this unpromising looking substance; and it would appear from the report of Dr. Letheby, that they exceed any other yet introduced as regards illuminating power. He gives the number of grains required to give the light of 1000 grains of the best spermaceti candles as follows:—

Ozokerite candles	754
Various paraffine candles	798 to 891
Sperm candles	1000
Wax candles	1150

As it has a very high melting-point; it does not bend or soften; it is, in fact, a much harder material than ordinary paraffine. It would be out of place to deal with Messrs. Field's numerous specialities in a periodical like the Chemical News; they are ingenious, and make up one of the most interesting cases in the Exhibition. For instance, the tinting of paraffine candles mauve and magenta with aniline colours is a great improvement upon the old opaque mineral colours. As regards paraffine candles, this firm claims priority over all others in the introduction of them to the public. They say, "We claim the merit of being the first in the English trade to manufacture for general sale, paraffine candles, and to have mainly contributed to their success, &c." Messrs. Wm. Brown and Co., of Glasgow, were actually the first makers in 1855, but to show the great stride that this article of industry has made, we may mention that in the letter addressed by Messrs. Field to the Secretary of the Exhibition of 1862, they state that whilst the candle was introduced at a price of 2s. 4d., and with a consumption of 3 to 4 cwts. weekly, it was at this time sold for 1s. 5d. This firm used 3 to 4 tons weekly; and in 1867 the total English make was some 2000 tons annually.

Messrs. Price and Co.—There is nothing particularly new about the case of this firm. It is certainly very handsome, and the contents excellent, but it is a mere reiteration in saying this of the articles turned out by the said firm. Added to which, all chemists must look at Messrs. Price and Co. with respect as the originators of pure glycerine, and the promulgators of a great chemical fact. Although distilled glycerine is now extensively manufactured abroad, the originators hold the palm as regards quality. This is mainly due to the fact of its great freedom from acrid products of distillation, which give a disagreeable odour to the glycerine if nothing worse. Glycerine can be, and frequently is, re-distilled by the aid of superheated steam. Very inferior glycerine is now in the market, but its genuineness is so easy of detection, that we are surprised to find such inferior qualities are sold at a high price. Pure glycerine should not give a white precipitate with nitrate of silver, and the resulting mixture should not deposit a precipitate on exposing it to the sun's rays. It should volatilise on heating a small quantity on a platinum foil without leaving a carbonaceous residue; and it should be quite destitute of odour. The "solidified glycerine" is a soap which is stated to consist of 25 per cent of pure glycerine.

* I do not by this mean that solution of iodate of calcium has any power to dissolve gold, or to retain it in solution when dissolved by any *direct* action. But, as has been shown in former papers, putrescible organic matter causes liberation of iodine in a neutral or slightly alkaline solution of iodate of calcium, and the iodine thus liberated continuously dissolves the gold that is being continuously precipitated, if such an expression referring to nascent conditions may be permitted. It is clear from the experiments given in the text, that organic matter is capable of precipitating gold *earlier* than the stage at which that balance of destructive and conservative forces always at issue between organised and inorganic matter arrives at which iodate of calcium begins to decompose, such decomposition leading the liberation of iodine, which, as shown, reacts upon any precipitated gold to dissolve it. From these premises we may easily see how, although sea-water must always retain some gold in solution, it may yet, under circumstances not only conceivable, but such as must necessarily occur in regions where the passage of organic matter to a state of putrescence is too rapid for the *formative* power of the iodate of calcium in sea-water to keep pace with it, cause precipitation of gold. Hence it is, as it appears to me, that gold-fields are found richer in tropical regions where decomposition goes on at a quick rate, than in colder regions where the re-forming power of iodate of calcium can exercise a more powerful solvent action upon the gold which sea-water has extracted from the original material of which the earth is composed.

Mr. John G. Rathborne, Dublin.—One of the most important Irish exhibitors is Mr. Rathborne, the contents of whose case are *bona fide* specimens of home manufacture. He is a wax-bleacher, and is one of the few firms from whom you can procure pure white wax; although the public have been educated to prefer the prettier article which is now sold under the name of *cera alba*. This house also works paraffine, but its chief interest is the refining of sperm oil and the manufacture of spermaceti. The head-matter of the sperm whale is a semi-crystalline mass of a very dirty and offensive appearance. It is separated into two distinct portions, the fluid, or sperm oil is clarified, and extensively used for lubricating and illuminating purposes. On its freedom from the crystalline portion mainly depends its commercial value; and so well is this understood that certain seasons of the year are considered preferable to others for its manufacture. The crystalline solid portion, or cetin, $C_{32}H_{64}O_2$, when purified by pressure and treated with alkalies, constitutes the spermaceti of commerce, which differs considerably, and more frequently than ordinary observers would imagine, owing to the variable quantities of sperm oil still remaining. The specimens of spermaceti shown (both crystallised and manufactured into other forms) are certainly the finest we ever saw as regards purity in this respect, which is mainly gained by hydraulic pressure.

Messrs. C. Ogleby and Co, London, exhibit candles and other products.

Newry Salt Company.—Different varieties of salt are shown by this Company; they are procured from rock-salt, and are beautifully pure.

Cantrill and, Cochrane, Dublin, show mineral and medicinal waters.

Messrs. McMasters, Hodgson, and Co., Dublin, are expressers of linseed oils, and rape oils. They also show the respective cakes, and some other proprietary articles, such as fluid annatto, all excellent preparations.

Messrs. Boileau and Boyd, Dublin.—The case belonging to this firm contains an interesting collection of chemicals, some of them rare. They have been arranged most artistically; and we noticed one very fine specimen of them made by crystallisation from damaged tea. It is used in medicine as a tonic and stimulant in doses of 1 to 5 grains.

The starch exhibitors are not very numerous, but are remarkably good, particularly the Irish manufacturers. It is perhaps, not generally known that Ireland is celebrated for its wheat-starch amongst the trade. With the general public rice has supplanted wheat-starch, owing to the fact that the outer envelope of the granules is more easily broken, and the starch can be made without boiling. Such, however, is not the case with the wheat granules, which require boiling to make the starch. It, however, possesses remarkable stiffening properties, which makes it invaluable for technical purposes. Thus whilst the rice-starch is used by the public, the wheat-starch is used by the Manchester houses.

The exhibitors of starch are as follows:—

J. and J. Colman, London.—Laundry starch prepared from rice, and also rice-starch prepared for dietetic purposes under the name of "Corn Flour."

Charles Cooney and Son, Dublin.—Laundry starch prepared from wheat.

John Kelly, Graigne.—Rice and wheat-starch for laundry purposes; very good.

Alex. Crawford and Son, Belfast.—Wheat-starch for laundry purposes, beautifully white. Wheat-starch prepared for dietetic purposes under the name of Irish corn flour. In speaking of their preparations they make the following remarks:—

The *Snow-white Starch* is a special manufacture of the firm remarkable for its beautiful colour, its great purity and strength; and is now used by the principal bleachers and finishers in the kingdom in the preparation of the finest goods. It is made from wheat alone, and retains its stiffening power for any length of time. It is supplied to the Royal Laundry, and gained the gold medal, London, 1870.

The *Irish Corn Flour* is a novelty in this line, being also made from wheat, and therefore possessing the many advantages of that cereal over its competitors rice, Indian corn, and sago; from which the previous corn flours have been made. It is a beautiful white colour, is highly commended for its flavour and fresh pleasant taste, it has great nourishing power, and is adapted to every variety of table use.

The mining exhibitors are not numerous, but are interesting. The first case in importance as well as show, is that of the—

Mining Company of Ireland.—This company has generally been a prosperous one, but under the very peculiar abnormal circumstances attending our coal supplies, we have no doubt that it will with the assistance of Mr. Harold, and their efficient staff of officers, be able to realise a rich harvest. All the works and property of this Company were, some years since (when the writer visited them), an honour to the country as illustrating the manner in which large manufacturing operations might be conducted in a cleanly, methodical, yet in an effective manner. Their lead and silver mines are situated at Glendalough, at the end of the valley which contains the celebrated ruins known as the "seven churches." One entrance to the old mine is about one-third of the way up the mountain. The mountain is bored right through, so that the levels go from one valley to the other. This old working is eighty fathoms deep (480 feet); and besides this they are now rapidly piercing the mountain for new workings. It has been calculated that to raise 1800 tons of dressed lead-ore fit for the market, 46,000 tons of ore are broken by the miner. The rejected stuff is blend, fluor-spar, quartz, and calx-spar. None of these are made available for the market. Very rare minerals have been found in these valleys. Gold, metallic silver, witherite, heavy spar, carbonate of lead. Blend is found in large quantities, but is not worked. About 1·3 per cent of the whole of the lead ore raised in the world is procured from this mine. Ireland yields also about 2·4 per cent of the whole of the silver raised in the world, or about £3850 per annum. The silver is procured by Patterson's process from the silver-lead, which is manipulated at the works of the Company situated at Ballycorus. The lead is converted into pig, sheet, shot, and pipe. They also procure litharge in the refining of the silver, red-lead (manufactured), and arsenic, which sublimes during the smelting of the lead, also antimony. Lead is extensively procured for type-founders, and shot. One of the most important points in connection with the Mining Company of Ireland, however, are their collieries.

The very important question of the price of coal and its supply will probably be ultimately and mainly regulated by Ireland; at any rate as regards its present abnormal inflated condition. The resources of the Irish coal were never thoroughly appreciated, but the writer has no hesitation in saying that the already known or worked mines are sufficient to compete with English coal, if enough energy and capital were only invested in them. Again, the behaviour of the Irish Railway is suicidal to the extension of this branch of industry. Let us take this Company alone. They are working at the present moment the "Bonlea," "Ballinastick," "Coalbrook," "Earlshill," and "Foilacamin" collieries. They are situated in the county of Tipperary. At the present moment they raise annually 50,000 tons, 45,000 tons of which are culm. Besides this, at their collieries at Cork, they raise annually 10,000 tons. It is chiefly anthracite of the very best quality, containing as much as 96 per cent of carbon: it may, in fact, be practically viewed as pure carbon; and is so much valued for some special purposes, such as malting, that 32s. are eagerly paid in Dublin for this coal. It is, although a flameless coal, valuable for steam purposes. We have been credibly informed that for the carriage of this coal, 2s. per ton is charged from

Limerick Junction to the town of Tipperary, a distance of 2½ miles. How can the resources of a country be developed in the face of such restrictions? There is certainly something here that requires explanation. The culm is used chiefly in lime-burning, for which it is particularly suited. Anthracite requires a great draught, but is one of the most valuable fuels we possess, both as regards the intensity of heat produced, and its freedom from sulphur. From Berthier's experiments on the reduction of oxide of lead, we find that anthracite stands very high; yet the sample he experimented upon was not equal to the Irish in quality (viz., Pennsylvania). Wigan cannel produces 28·3 parts of lead; Newcastle 30·9; Glasgow 24·9, and anthracite 30·5.

General Mining Company of Ireland, Dublin.—Calamine and oxide of zinc are shown in all their stages of manufacture. This Company possesses at the silver mines in Tipperary the largest deposit of calamine in the United Kingdom; and they manufacture their oxide directly from the ore. The oxide is generally made from spelter. By their process, which is a patent, the Company can make oxide very cheaply, but as it is made directly from the ore the resulting oxide always contains lead, which vitiates to a certain extent its value as a pigment when made by this process. The mining Company are anxious to prevent this by some modification of their process, because if such a change could be brought about the spelter oxide could not compete with it in price. They also show caustic soda made by a patent process in which the inferior brands of oxide are utilised for the production of this article.

This latter process is one which the above named Company are now experimentally determining the merits of. The patentee is a Mr. Crockford.

Connoree Mining Company, Dublin.—Pyrites and copper ores from their mines in Wicklow, &c., and specimens of copper by precipitation. Most of the ingots of gold got in this country have been found in the workings of this Company.

The Geological Survey of Ireland.—The geological maps of Ireland, published by the survey.

Greenagh Colliery, Dungannon.—Specimen of cannel coal, Coal Island, Dungannon. Used in the manufacture of gas, and marked 35s. at colliery.

Val de Travers Company.—Specimens of natural asphaltes used in the pavements laid by this Company.

Messrs. Millard and Robinson, Dublin.—There is nothing particularly novel in the way of photographic processes exhibited, if we except some beautiful specimens shown by Messrs. Millard and Robinson. The following seems to be the *modus operandi* by which these excellent results are obtained. An ordinary silver print upon albumenised paper is taken, and the minute defects are painted out with the ordinary tube oil colour thinned with turpentine only. When dry, it is immersed for 30 minutes in water, so as to thoroughly soften the paper, and finally in water at 65° C. A plate of glass, which should be scrupulously clean, is warmed to about 90°, and a solution of Nelson's transparent gelatine is poured over the surface of the glass quickly and so as not to chill the gelatine, and the print is lifted from the warm water and laid face downwards upon the gelatine solution. It must then be carefully and dexterously manipulated, so as to press the print in close contact with the glass, and to expel the superfluous gelatine solution. All air bubbles must be excluded. If a flat plate of glass is used the manipulation will be easy, but by preference convex, or oval convex, or lunette glasses give much better effects. The gelatine solution is made by macerating the transparent gelatine for 12 hours in cold distilled water, pouring off the superfluous fluid and applying heat to melt the gelatine, when it will be found to have just absorbed the requisite quantity and to dissolve thoroughly. It is strained through fine muslin, and is then ready for use. Simple as this process may seem, the effects must be seen to be appreciated. Thus the details in the deep shadows will be brought out in a "*fixe*" which would not be visible in the ordinary print. Mr. Robinson, who has introduced this process, also claims, for the photographs thus treated, permanency. He says, "Some idea of the effects of this method of treating photographs may be obtained by taking a photo-print and sizing one half, and comparing the effect produced with the unvarnished half. The glass replaces the varnish, and it is evident that no varnish can compare with the glass in the qualities which make, or give, value to a varnish."

The other exhibitors who might possess an interest for the readers of the Chemical News, are as follows:—

Piston Freezing Company, London.—Patent freezing machines, seltzogens, and other apparatus.

J. Spencer and Son, Dublin.—Jellet's saccharometer (fully described in the Chemical News, vol. xi., p. 294), and other philosophical instruments.

Dublin Glass Bottle Company, North Lotts, Dublin.—Specimens of glass in various stages of vitrification, and bottles in all their stages of manufacture.

Walker, Campbell, and Company, Liverpool.—Hains's patent lead encased block-tin pipe. The proprietors of this pipe state that they have succeeded in combining the two metals, tin and lead, in such a way as to render them in the form of a pipe perfectly homogeneous, the result of this combination being, that the pipe possesses all the ductability and pliability of the lead with the innocuous nature and tenacity of the tin. They also say that, although the cost per ton is double that of the ordinary lead-pipe, the weight per yard required for a given pressure is only half, therefore the cost is the same. Thus Hains's patent pipe by experiment was ½ inch inside diameter, the weight per yard 4·017, the extension was 13·6 per cent, and the bursting pressure was 1859 lbs. per square inch. With common lead-pipe the inside diameter was ½ inch, the weight per yard was 7·13 lbs., the extension was 9·7 per cent, and the bursting pressure per square inch 1579. Dr. Lankester said he had submitted these pipes to the action of distilled water, Thames, and other waters, and neither lead nor tin could be detected in the water. Also acid decoctions seem to be without action upon the tin.

Messrs. Bryan Corcoran, Witt, and Co., Mark Lane, London.—Specimens of wire-weaving for sifting, &c., Iron gauze, containing 10,000 holes to the inch, and brass wire gauze 150 holes to the inch are shown.

W. S. Rumsey, London.—Various polishing and other pastes.

Bermondsey Indian-Rubber Works, London.—Indian-rubber in all its stages and in the raw state.

D. Tallerman, 90, Cannon Street, London.—Australian preserved meats, meat extracts, &c.

James Tennant, jun., Smithfield.—Specimens of minerals from Nova Scotia, St. Helena, Algoa Bay, and South Africa. Collected by the exhibitor during his travels.

Anti-Adulteration Society, Dublin.—Products used in adulterating. Adulterated manures, &c.

Thomas G. White, Dublin.—Charcoal, pyro-lignite, acetate of lime, acetate of soda, acetic acid, &c., from the destructive distillation of Irish wood.

John Somerville, Gas Company, Dublin.—These are a very complete series of products illustrative of the destructive distillation of coal in the process of gas making. Mr. Somerville is the engineer to the extensive gas works in this city, and besides all the direct products of distillation, such as carbolic acid, benzoin, toluol, &c., he shows all their derivatives, including the anthracene derivatives and the aniline colours.

Messrs. Berger Spence and Co., Manchester.—This firm exhibits a beautiful crystal of alum; the specimen being made from coal shale, pyrites, and refuse from the ammoniacal gas works. This fine crystal exhibits a very faint amethyst tinge.

Messrs. Boyd and Alexander, Dublin.—Chloride of lime (38 per cent), commercial acid, manures, &c.; a good collection.

Marine Salts Company, Dublin and Galway.—A very excellent collection, illustrative of the products manu-

factured by this Company from sea-weeds collected upon the west coast of Ireland. They exhibit iodine, bromine, and the accompanying salts; also the principal sea-weeds from which the kelp is derived with their relative value in iodine given—*e.g.*, *Laminaria digitata*, *Laminaria saccharina*, rich in iodine; *Fucus serratus*, poor in iodine.

Dublin and Wicklow Manure Company.—Good specimens of commercial acids, manures, &c.

Messrs. Bewley and Draper.—Mineral waters and dichroic ink. The preparations of this firm are so well known and appreciated in Ireland that it is superfluous to dwell upon them.

Messrs. Yeates and Son, Dublin.—This firm shows astronomical telescopes and spectroscopic apparatus. The compound prisms for the latter are very beautifully made.

Amongst the soap makers there are two that require special mention.

Messrs. Holt, Nerwich, and Co., Vauxhall Walk, Lambeth, London, exhibit pure oil soaps for technical purposes. The light oil soaps are made for using with silks, poplins, and woollen goods. The black oil soaps are half the price, but of course can only be used for black goods. The great advantage claimed for these soaps are that they never congeal, and may be used indifferently in hard, soft, and salt waters. The soaps were examined by the reporter, and found to be genuine cheap soaps perfectly saponified. The amount of causticity was slight (= 1·8 per cent soda). The specimen was almost entirely soluble in spirit, the residue being only 1·6 per cent, whilst the amount of moisture was comparatively low for a new specimen of soap, viz. 18 per cent. Such soaps are no doubt valuable adjuncts to the trade.

Messrs. Fred. Lewis, and Co., Fleet Street, Dublin, are worthy of more than simply their names appearing as soap and perfume makers, from the fact that they manufacture largely much of the exported soaps that go to our Colonies. They also, some time since, contradicted and exposed a statement that was going the round of the scientific world, that the perfumed soaps, such as windsor, &c., were made from horse-green. In the higher class of perfumed soaps, the actual cost of the soaps used (which are generally two) is a secondary consideration. They show a pillar of perfumed soap which is probably the largest ever cast in one piece; and show beautiful samples of curd and white windsor. The soaps shown by Messrs. Lewis, and Co. are perfectly neutral.

British Seaweed Company, Dalmuir, Glasgow.—Mr. Edward Stanford's well-known process for manufacturing the products of seaweed are well known, and the importance of his patent must be felt with the present high price of iodine. The remarkably large produce of iodine must give them a decided advantage. The increased produce is due to the non-volatilisation of the iodides, such as occurs during the ordinary process of the burning of the kelp. A series illustrating their process is given in the case, also one showing, the carbon closet system, which has been fully described in the Chemical News, vol. xxv., p. 75. The method of excretal removal is a modification of the earth closet system, in which some form of carbon is substituted for earth. By the use of charcoal the amount of deodoriser required is reduced to less than a fourth as compared with earth, and a constant supply is secured. The system is being adopted by many of the large public works.

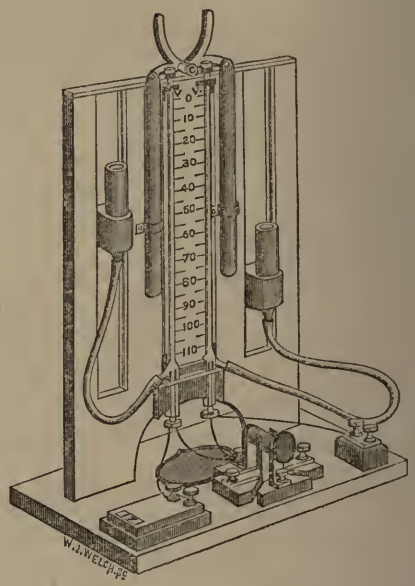
ON MEASURING TEMPERATURES BY ELECTRICITY.*

By C. WILLIAM SIEMENS, D.C.L., F.R.S., M.R.I.

(Concluded from p. 154).

Although I have explained that, by means of a differential galvanometer and a variable resistance (constituting in effect a Wheatstone bridge arrangement), the increasing resistance of the platinum spiral may be measured, it was found that the use of a delicate galvanometer is attended with considerable practical difficulty in iron-works and other rough places where it is important to measure elevated temperatures, or on board ship for measuring deep sea temperatures. I was therefore induced to seek the same result by the conception of an instrument which is independent in its action from tremulous motion, or from magnetic disturbance caused by moving masses of iron, and which requires no careful adjustment or special skill on the part of the operator. This instrument is represented by Fig. 4, and may be termed a chemical resistance measurer or "differential voltameter." The immortal Faraday has proved that the decomposition of water in a voltameter expressed by the volumes of gases V,

Fig. 4.



is proportionate in the unit of time to the intensity, I, of the decomposing current, or that—

$$I = \frac{V}{T}.$$

According to Ohm's general law, the intensity, I, is governed by the electro-motive force, E, and inversely by the resistance, R; or it is—

$$I = \frac{E}{R}.$$

It is therefore—

$$\frac{V}{T} = \frac{E}{R} \text{ or } V = \frac{ET}{R};$$

or the volume, V, would give a correct measure of the electrical resistance, R, if only the electro-motive force, E, and time, T, were known and constant quantities. But the electro-motive force of a battery is very variable; it is influenced by polarisation of the electrodes, by temperature, and the strength and purity of the acid employed. The volume of gases obtained is influenced, moreover, by the atmospheric pressure, and it is extremely difficult to make time observations correctly. It occurred to me, however, that these uncertain elements might be entirely eliminated in combining two similar voltameters in such a manner that the current of the same battery was divided between the two, the one branch comprising the unknown resistance to be measured, and the other a known and constant resistance. The volume of gas, V^1, produced in

* Read before the Royal Institution of Great Britain.

this second voltameter, having a resistance, R^1, in circuit, would be expressed by—

$$V^1 = \frac{ET}{R^1},$$

and we should have the proportion of—

$$V : V^1 = \frac{ET}{R} : \frac{ET}{R^1};$$

or E and T, being the same in both cases, may be struck out, and the expression will assume the simple form—

$$V : V^1 = R^1 \div R.$$

The constant resistance, R, of the one circuit being known, it follows that the unknown resistance, R^1, is expressed by—

$$\frac{Rv}{V^1};$$

that is to say, by a constant multiplied by the proportion of gas produced in the two voltameters irrespective of time, or strength of battery, or temperature, or the state of the barometer.

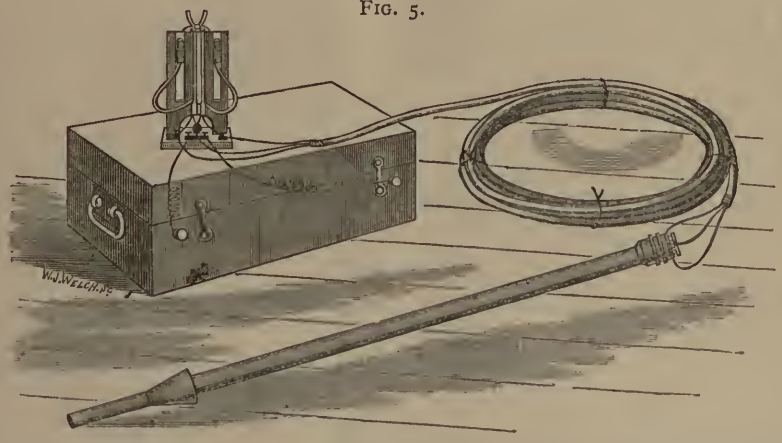
The resistance, R and R^1, are composed each of two resistances, viz., that of the principal coils, which we may term R or R^1, and of the voltameter and leading wires, which is the same in both cases, and may be expressed by y. The expression should therefore be written as follows :—

$$V : V^1 = R^1 + y^1 : R + y,$$

R^1 being the unknown quantity.

The mechanical arrangement of the instrument will be understood from the diagram, Fig. 4; and the whole arrangement of the pyrometer, with its leading wire and resistance measurer, from the general view given in Fig. 5. The voltametric resistance measurer consists of two calibrated vertical tubes of glass of about 3 m.m. diameter, which are fixed upon a scale showing arbitrary, but equal divisions. The upper ends of the tubes are closed by small cushions of india-rubber pressed down upon the openings by means of weighted levers, whereas the lower portions of the tubes are widened out and closed by plugs of wood, through which the electrodes in the form of pointed platinum wires penetrate to the depth of about 25 m.m. into the widened portions of the tubes. By a side branch, the widened portion of each vertical tube communicates, by means of an india-rubber connecting-pipe, to a little glass reservoir containing acidulated water, and supported in a vertical slide. In raising the weighted cushions, closing the upper ends of the vertical tubes, and in adjusting the position of the small reservoirs, the acidulated water will rise in both tubes to the zero line of the scale. In turning a button in front of the tubes, the battery current is passed through both pairs of electrodes, the one circuit comprising the permanent resistance, R, and the leading wires up to the pyrometer, and the other the leading wires and the pyrometer coil. If the resistance of the pyrometer coil should be equal to the permanent resistance, R, the R^1+y will be equal to $R+y$, and therefore $V=V^1$, but as the resistances differ, so will the volumes. Necessary conditions are: that both reservoirs are filled with the same standard solution of pure water with about 10 per cent of sulphuric acid, that all the electrodes are of the same form and size, and that their polarity is reversed frequently during the progress of each observation, in order to avoid unequal polarisation. With these precautions, which involve no particular skill or knowledge of electrical observation on the part of the operator, very accurate results are obtained; but in order not to incur considerable error of observation, it is advisable to continue the current, reversing the same say twice, until at least forty divisions of gases are produced in the least activated tube, which operation will occupy from two to three minutes; if a battery of from 4 to 6 Daniell elements is employed. The volumes, V and V^1, being noted, after having allowed half a minute for the gases to collect after the current has ceased, the weighted cushions upon the tubes are raised,

Fig. 5.



in order to allow the gases to escape, when the water levels will immediately return to their zero position, to make ready for another observation. By inserting the observed values for V and V^1 into the expression above given, the unknown resistance, R^1, can be easily calculated; but, in order to facilitate the use of the instrument, I have prepared a Table which gives at a glance the resistance due to any two observed volumes, the volumes V governing the vertical, V^1 the horizontal columns, and the resistance being read off at the point of intersection. At each point of intersection the resistance is marked in black, and the corresponding temperature in red ink.

It now remains only to be shown what is the relation between the resistance and temperature in heating a platinum wire. The researches of Dr. Matthiesen, who has made the latest investigations on the effect of temperature upon electrical resistance, are restricted to the narrow range of temperatures between 0° and 100° C., nor do they comprise platinum. He adopted the following general expression for the pure metals :—

$$R_t = \frac{R_0}{1 + xt + yt_2},$$

which, in determining the specific values of x and y for each metal, gives a close agreement with observation between the narrow limits indicated, but is wholly inapplicable for temperatures exceeding 200° C., when the value t^2 commences to predominate and to produce absurd values for R_t.

It was necessary for my purpose to undertake a series

of elaborate experiments with a view of finding a ratio of general application. Coils of thin wire, of platinum, iron, copper, and some other metals, were gradually heated and cooled in metallic chambers containing the bulbs of mercury thermometers, and for higher temperatures of air thermometers, and the electrical resistances were carefully noted. The progressive increase of electrical resistance was thus compared directly with the increasing volume of a permanent gas (carefully dried) between the limits of zero and 470° C. and a ratio established, which is represented by the formula

$$R_t = aT^{\frac{1}{2}} + \beta T + \gamma,$$

in which T signifies total temperature counting from the absolute zero, and a β and γ specific coefficients for each metal. According to this formula the electrical resistance is a constant at the absolute zero, and progresses in a ratio represented graphically by a tipped-up parabola, approaching more and more toward a uniform ratio at elevated temperatures. Although the comparison with the air thermometer could only be carried up to 470° C., the general correctness of the ratio of increase just stated has been verified by indirect means in measuring progressive heats, and by comparison with the platinum ball pyrometer.

It is important to mention here that great care must be exercised in the selection of the platinum wire for the measuring spiral, platinum wire having been met with conducting only 4·7 times better than mercury at zero, C., and others; conducting 8·2 times better than mercury, although both samples had been supplied by the same eminent makers, Messrs. Johnson and Matthey. The abnormal electrical resistance of some platinum wire is due chiefly to the admixture of iridium or other metals of the same group, and it appears that the platinum prepared by the old welding process is purer and therefore better suited for electrical purposes than the metal consolidated by fusion in a Deville furnace.

In conclusion, I shall show some working results of the pyrometer in measuring by means of the same protected coil a mixture of ice and water, boiling water, molten lead, and the fire itself by which the lead is melted, the readings produced being 2° C., 98° C., 330° C., and 860° C. respectively. The latter temperature signified a cherry-red heat, as may be judged by the appearance of the tube when withdrawn from the fire. The instrument which I have had the honour to bring before you this evening has already received several useful applications. Through its first application an important telegraph cable was saved from destruction through spontaneous generation of heat. Professor Bolzani, of Kasan, has made some interesting applications of it for recording the temperature at elevated points, and at points below the earth's surface. Mr. Lowthian Bell has used it in his well-known researches on blast-furnace economy; and at several iron works pyrometer tubes are introduced into the heating stoves, and permanently connected with the office, where the heat of each stove can at all times be read off and recorded. These and other applications are sufficiently self-evident, if the soundness of the principles upon which I rely is conceded; but I feel that the shortness of time at my command has hardly enabled me to do more than pass these in review, while endeavouring to demonstrate the results obtained of recording the temperatures of distant or inaccessible places, including furnace temperatures.

ON DYES AND DYE-STUFFS OTHER THAN ANILINE.*

By Dr. F. CRACE CALVERT, F.R.S.

(Concluded from p. 152).

I SHALL now proceed to give you a brief outline of the characteristic differences of the several tannin matters.

* The Cantor Lectures, delivered before the Society of Arts. Revised and communicated by the Author.

Gall-nuts are the most valuable and important of all tannin matters. They are produced by the female of an insect called *Cynips*, which pierces the buds on the young branches of the *Quercus infectoria*, a tree growing especially in the East. There she soon deposits her eggs, and the bud loses its natural growth, and swells out to the size of a hazel-nut, having a green, red, or pink colour. The eggs thus inclosed soon hatch, and the insect undergoes all its metamorphoses until it attains the perfect state, when, if allowed (which is not to the interest of either the gatherer or consumer), it makes a hole and escapes. Good gall-nuts should not be so pierced, and they should be heavy, and of a fresh green colour. If the insect has escaped they are yellow, and are not of nearly so good quality.

In the market, they generally bear the name of the port from which they were shipped. Thus, there are Aleppo gall-nuts, which are considered the best in the market, then the Morea, Smyrna, &c.

The following may be considered as the composition of an average sample of gall-nuts:—

Tannic acid	65·0
Gallic acid	2·0
Ellagic acid } Luteo-gallic acid }	2·0
Chlorophyl and volatile oil	0·7
Brown extractive matter	2·5
Gum	2·5
Starch	2·0
Lignine	10·5
Sugar, albumen, &c., and ash	1·3
Water	11·5
	100·0

Gall-nuts are employed to produce blacks on silks, in the preparation for Turkey-red, to produce fast blacks in calico-printing, and, lastly, large quantities are used in the manufacture of pyrogallic acid, the consumption of which, in the present large requirements of photography, must be enormous. We shall see, as we proceed, that gall-nuts are the only available tannin matter for the production of this acid.

An inferior quality of gall-nut is also sold, which is found on the *Quercus*, called *Knoppern*, which grows in Hungary, Styria, Croatia, and Piedmont. It is used in those countries for tanning leather, and in some parts of Germany as a cheap substitute for the Eastern nuts.

Sumach is, as Dr. Stenhouse's researches show, the only substance in which the tannin principles are identical with those of gall-nuts, although in this tannin matter there is a comparatively large quantity of gallic acid. It also contains a soluble yellow principle.

Sumach is found in commerce as a coarse powder obtained by the trituration of the young branches and leaves of several varieties of the family *Terebanthaceæ*. The species most cultivated is the *Rhus coriaria*, which is a plant indigenous to Italy, Sicily, France, Spain, and Portugal. The shrub grows to a height of 16 feet in the most arid soils, and is very extensively cultivated in some of those countries. The twigs and leaves are gathered once a-year.

Although sumach varies greatly in the amount of tannin it contains, there can be no doubt that from the *Rhus coriaria* is the best, whilst the most inferior comes from the South of France, and is the produce of the *Coriaria myrtifolia*.

In consequence of the powdered state in which sumach is sold, it not only varies greatly in quality, but is often deliberately adulterated with sand, or the leaves of other plants. It is easy to discover the sand, it being only necessary to put some of it in water, when the sand, from its greater specific gravity, readily falls to the bottom of the vessel. I will describe the method of determining the amount of tannic acid later on.

Extract of sumach is sometimes employed in print-works, to produce yellows with acetate of tin, blacks and greys with iron mordants, and dark yellow with sulphate of zinc. It is also used to produce blacks on woollen fabrics, although it does not give as good blacks as gall-nuts. Its principal use, however, is to mordant, either alone or in conjunction with salts of tin, the cotton warps of the mixed fabrics so extensively manufactured in Yorkshire, by which means the cotton takes the same colours as the woollen weft, both with vegetable dye-stuffs and those derived from coal-tar.

Sumach is too expensive a tannin matter to be used for the tanning of leather, but it is employed by the currier in the preparation of skins for dyeing with light shades.

Valonia is the acorn-cup of the *Quercus ægilops*, which grows in the isles of the Grecian Archipelago and on the coasts of Asia Minor. It is especially employed for tanning leather and adulterating garancine.

Divi-divi is the pod of the *Cæsalpina coriara*, and is chiefly imported from South America.

Myrobalans, which are largely used for tanning leather and producing blacks on wools, are the dried fruit of the *Terminalia chebula*, and are imported chiefly from Calcutta.

Dr. Stenhouse has shown that the tannin matter of valonia, divi-divi, myrobalans, and oak bark, are not identical with those of gall-nuts and sumach. They do not yield gallic acid when boiled with dilute sulphuric acid, but sugar and some other organic principle.

From the above facts it must be obvious to all who use tannin matters, whether dyers or tanners, that these substances not only vary in value, according to the variety of plant from which they have been obtained and the country whence they are imported, but there are sources of deterioration which cannot be detected by the eye. Thus, for example, if a new sumach be mixed with a comparatively old one, it is impossible to detect the fraud. The only method, therefore, of ascertaining the value of a sample is to determine chemically the amount of tannic acid it contains. This may be done by the following process:—A weighed quantity (say 100 grains) of the substance to be tested is boiled with distilled water, and the decoction run off into a beaker, without filtering. This process is repeated four or five times. A test solution is prepared by dissolving 1 drachm of gelatine in 4 ounces of water, and adding 15 grains of powdered alum to the solution: 155 grains of this solution represent 5 grains of pure tannic acid. The test fluid is carefully dropped into the beaker until, on the falling of a drop upon the surface, the characteristic ring of tannate of gelatine is no longer produced. The quantity of test fluid used is then ascertained, and from this the amount of tannic acid is calculated.

Before passing from this class of tannin substances, there is one that I must mention, which has been used from the most ancient times, in Egypt, Arabia, and other Eastern countries, to dye wool, horse-hair, leather, &c. It is the leaves of the *Lawsonia inermis*, which appears to be the gopher wood of Scripture and the henna of the Egyptians. The leaves are mixed with water, to form a paste of an orange-brown colour. This paste also is employed by the Asiatic ladies to dye the nails of their hands and feet, as well as their ears and hair.

Catechu, *gambier*, and *gum-kino* are the most valuable of the tannin substances, which give a green colouration with per-salts of iron. They are most extensively used to produce a great number of shades, varying from light drabs to dark brown, in cheap dyed cotton goods, such as fustians and corduroys. They are used in calico-printing chiefly to produce browns, in silk dyeing to weight the silk, and in tanning to produce a low class of leather, easily distinguishable from that properly tanned with bark and other matters belonging to the first class, because when used for making shoes it communicates to the stockings a peculiar orange-yellow hue.

For a long time there was much doubt as to the genus of plants from which catechu, gambier, and kino, which resemble each other very closely in their properties, were derived. M. Guibourt, a few years ago, solved the problem. He found that real *catcchu*, or *cutch*, was obtained from the wood of the palm called *Areca catechu*, and the *Acacia catechu*, whilst gambier is extracted from the leaves of the *Uncaria gambir*, *terra japonica*, belonging to the family *Rubiaceæ*, and kino is obtained principally from the *Butea frondosa*, a leguminous plant.

Catechu is found in commerce principally in two states; the best in lumps varying in weight from 80 to 90 lbs., of a dull purple colour, and covered with leaves; the second in masses, more or less covered with sand.

Gambier is imported into this country in the form of small cubes, having a yellowish-brown colour.

Good catechu should not leave, on incineration, more than 4 or 5 per cent of ash. Its aqueous solution should give, with alcohol or gelatine, an abundant white precipitate, with lime and baryta a brown precipitate, with salts of lead and tin a yellow precipitate varying in shade with the salts employed, and with bichromate of potash a brown precipitate. It should also take a decided brown hue with alkalies, and assume a greenish colour with salts of iron.

Catechu, besides naturally varying widely in quality, is freely adulterated with mineral substances, starch, tannin matters, and blood.

I have just stated the amount of ash a good catechu should yield. To ascertain the presence of starch, the sample should be first treated with alcohol, and the insoluble residue boiled with water, which will give a fine blue colouration on the addition of iodine if starch be present. The presence of any ordinary tannin matter in the catechu will modify the green colouration which the latter substance gives with the per-salts of iron. Blood may be detected, if present, by treating the catechu with alcohol, and, after drying the insoluble residue, heating it in a tube, when ammoniacal vapours will be given off, as well as vapours of a most offensive odour.

Catechu is composed of three distinct substances,—first, a tannin matter called *mimo-tannic acid*; second, *catechine*, or *catechinic acid*; and, lastly, a brown colouring matter due to the oxidation of the catechine.

Mimo-tannic acid is prepared by treating pulverised catechu by ether in a displacement apparatus. The ethereal solution leaves, on evaporation, a yellow porous mass of this acid. Bombay catechu yields about 55·5 per cent of mimo-tannic acid; that from Bengal, 48·2 per cent; while gambier yields from 36 to 40 per cent.

Catechine, or *catechinic acid*, is obtained by treating with boiling water the residue from catechu, which has yielded its mimo-tannic acid to ether. The water on cooling deposits a brown crystalline precipitate, which is re-dissolved in water, and yields with sub-acetate of lead, and the precipitate washed. The lead compound is then suspended in water, and decomposed by sulphuretted hydrogen, when pure catechine remains in solution. Its formula is $C_{10}H_{10}O_4$. It rapidly becomes coloured brown in the presence of air, and an alkali, being, it is said, converted into *japonic acid*, whilst, with alkaline carbonates, it yields *rubinic acid*. It is also converted into japonic acid under the oxidising influence of salts of copper and of bichromate of potash.

If dyers, instead of employing catechu as imported, were to grind it, and wash with cold water, they would obtain an extract which would yield very pure shades of green drabs, while the insoluble residue of catechine would give a great variety of shades of brown. To increase the permanency of catechine colours, the goods dyed with them should be passed through a solution of bichromate of potash, as is usually done for catechu browns.

Dr. Stenhouse has shown that the tannin matters giving a green colouration with per-salts of iron, such as

catechu and elder and larch barks, do not contain a glucoside. The only exception he has found to this rule is willow bark.

PROCEEDINGS OF SOCIETIES.

SCIENTIFIC AND MECHANICAL SOCIETY, MANCHESTER.

At the last monthly meeting of the above Society, which was held on Wednesday, the 4th of September, a resolution was unanimously passed—"That a special committee be appointed to take into consideration the Society's future programme, and to make the necessary arrangements for carrying out the same. This committee to revise the existing or draw up new rules, and organise additional sections to their own (the engineering section), representing the staple industries of the district in all its most important branches, similar to the well-known Société Industrielle de Mulhouse, to consider the advisability of taking immediate steps for the establishment of a Technical Reference Library and Reading Room, and the publication of the Society's proceedings. The mover of the resolution in his remarks said it was hoped there would at least be a section devoted to Technical Chemistry, another to Spinning and Manufacturing, &c., for the coming session, which would begin in November. If we looked upon that eminently useful and authoritative body, the Société Industrielle de Mulhouse, it was difficult to understand that a similiar movement should not have been set on foot in such an important centre of industry as Manchester was long ago; but it seemed evident that it simply required a start, it was clear that there was ample scope and an urgent want for such an extension of their Society. He hoped that those gentlemen who mooted the subject in letters published some time ago in the Chemical News would join and co-operate with them.

A committee with full powers was then elected, consisting of Messrs. Von Hohenhausen, Dreyfus (analytical chemists), Hilton (manufacturer), Spriggs, Lynde (mechanical engineers), Tolhausen, Ziffer, Ross (civil engineers), Hacking and Hildebrandt (civil engineers), the hon sec. of the Society.

This committee held its first sitting on the Wednesday following, and appointed deputations to wait upon gentlemen of influence and practical experience representing chemistry and engineering, and willing to take an active part in their labours.

At the second committee meeting, which was held the following Wednesday, Messrs. Richard L. Messtayer, C.E., and Charles J. Allport, M.E., were added to the committee, and at the last meeting, held last Wednesday, the 25th inst., at the "Trevelyan" Hotel, Messrs. F. Spence (Pendleton Alum Works), John Gilchrist (ditto), Hart (Messrs. Tennants and Co.), Evan, Levinstein, and James N. French, gentlemen engaged in chemical manufacture, attended, and were elected members of the committee, all expressing their conviction that a movement of the kind as contemplated was a great desideratum, and promising their hearty co-operation.

Thus it will be seen that a very important point has been settled: There will be a Chemical Section, and efforts will also be made for the organisation of a technical library and reading room. Arrangements will be made that the sections meet on different days, so that each member of the Society may be able to attend each meeting if he so chooses. It is hoped that after sections may be organised in due course, and those gentlemen desirous to co-operate with the committee or to become members of the Society—the name of which will probably be altered also—are requested to communicate with the hon. sec., 64, Freme Street, Manchester.

CORRESPONDENCE.

NEW PROCESS FOR ANALYSING COMPOUND ETHER.

To the Editor of the Chemical News.

Sir,—Allow me to state in your columns that one of the processes for analysing compound ethers, brought before the British Association at its recent meeting, by Prof. Wanklyn, viz., heating the ethers with an alkali and estimating the amount of alcohol liberated, has already been described by myself as long ago as the year 1867, and will be found fully explained in the *Journal of the Chemical Society* of that year, as also in the work on Wine by Dr. Thudichum and myself.—I am, &c.,

A. Dupre, Ph.D.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, September 23, 1872.

This number contains, in addition to several original papers and memoirs relating to mathematics, natural philosophy, geology, astronomy, and natural history, the following original papers relating to chemistry:—

New Method for Preparing Chromic Acid.—E. Duvillier.—The process consists in the decomposition of chromate of baryta by nitric acid. 100 parts of the chromate of baryta, 100 of water, and 140 of nitric acid (sp. gr. = 1·384) are boiled together for ten minutes; it is essential that the water be first added to the chromate, so as to form with it a kind of thickish magma, to which the nitric acid is next added. After ebullition, there are added 200 parts of water, and then the mixture is again boiled for ten minutes; on cooling, the greater part of the nitrate of baryta is deposited in crystalline state, but, after decantation, a further evaporation is required to eliminate the rest of the nitrate of baryta, which, however, may be got rid of by means of dilute nitric acid, thus yielding a solution of chromic acid, which crystallises after evaporation to a small bulk. By this method, very pure chromic acid is obtained, while none is left behind in combination with the baryta.

Different Vibratory Motions Produced by Explosive Compounds.—P. Champion and H. Pellet.—This essay contains the record of a series of experiments made with the view of studying the vibratory motions caused by the explosion of iodide of nitrogen, fulminates, and nitro-glycerine. It appears that, under certain conditions, the vibrations produced cause musical sounds to be distinctly recognised.

Journal de Pharmacie et de Chimie, September, 1872.

This number contains the following original papers and memoirs more particularly relating to chemistry:—

General Method of Immediate Organic Analysis.—Dr. Fleury.—The conclusion of this monograph. This portion is divided into the following sections:—Treatment with cold water; treatment with boiling water; treatment with dilute hydrochloric acid; treatment with caustic potassa; distillation with water; distillation with acidulated water; distillation with an alkali.

Existence of an Organic Alkali in Boldo.—E. Bourgoin and C. Verne.—The boldo is a tree, a native of Chili, belonging to the natural order of the *Monimiaceæ*, described by Baillon as *Peumus boldus;* the leaves of this tree have an aromatic camphor-like taste, and contain an essential oil, and an alkaloid which the authors term boldine, which is extracted from the dry and previously-pulverised leaves by first eliminating the essential oil and other complex volatile principles, and next treating the residue with alcohol at 90 per cent containing tartaric acid in solution. By a rather tedious and lengthy process of purifying, the boldine (the leaves operated upon by the authors only contained 1-1000th part of that substance) is set free; it is difficultly soluble in water, to which it imparts, however, an alkaline reaction and very bitter taste. Boldine crystallises, is soluble in alcohol, ether, chloroform, and benzine, and, when dissolved in acids,

it is precipitated by ammonia and by the double iodide of mercury and potassium; with iodine-water, this solution yields a chestnut-brown colour; nitric and sulphuric acids impart in the cold a red colour to boldine.

Although not strictly belonging to chemistry, we call attention to the following excellent memoir:—

Report on Absinthe.—MM. Boudet, Dubail, and Adrian.—The authors, having been requested to make a full inquiry into this subject (absinthe being very largely abused in France), have thoroughly investigated the matter, and come to the conclusion that the *liqueurs d'absinthe* are strictly dangerous poisons.

Bayerisches Industrie und Gewerbe-Blatt, September, 1872.

This number contains the following original communications and papers relating to chemistry and collateral matters:—

Rules to be Observed in the Management and Firing of Steam-Boilers so as to Prevent Explosions.—W. Born.—Valuable advice concerning the care to be taken with all that relates to steam-boilers.

Coating of Metals with Nickel by the Aid of Galvanism.—Prof. Böttger.—This lengthy essay treats not only on the electro-nickeling of metals, but also on electro-plating in general.

New Method of Gas-Lighting.—Dr. G. Feichtinger.—This paper, illustrated by a woodcut, contains the detailed account of an ingeniously-contrived and simple arrangement by which benzoline is applied, without a wick, for the production of a cheap and brilliant light, which is already largely applied in many parts of Germany.

Treatment and Removal of Stains of Various Origin from Woven Fabrics.—Dr. L. Rigler.—In a tabulated form, the author gives brief, but useful, hints for the suitable treatment of stains of various nature on dyed, as well as white, woven fabrics of silk, wool, cotton, and flax.

Annales de Chimie et de Physique, October, 1872.

This number contains the following original papers and memoirs:—

Researches on Dulcite and on Sugars in general.—Dr. G. Bouchardat.—The conclusion of the monograph on this subject.

Expression of the Elastic Force of a Saturated Vapour in Relation to Temperature.—L. Saint-Loup.—An algebraico-physical essay.

Spontaneous Ascension of Liquids in Capillary Tubes.—C. Decharme.—Illustrated by engravings and several tables exhibiting the results of experiments.

The American Journal of Science and Arts, September, 1872.

In addition to original papers relating to astronomy, natural philosophy, natural history, geology, and palæontology, this number contains the following paper bearing on chemistry:—

Red Oxide of Zinc of New Jersey.—A. A. Hayes.—This mineral, which has been known for some forty years, has often been the subject of scientific research, on account of its peculiar colour, and the contents of this memoir are mainly devoted to the discussion of the cause of that colour. The composition of the mineral, in 100 parts, is—Oxide of zinc, 93·48; protoxide of manganese, 5·50; scales of specular iron, 0·44; ferric deutoxide, 0·36; loss, 0·22. According to the author, the colour exhibited by this mineral is due to a silicate of zinc, calcium, and ferric oxide, which is dispersed through the mineral in mica-like fashion. Some specimens of the mineral carnallite present a full rich red colour, due to a similar cause, viz., the mica-like dispersion of specular iron scales through it.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, October, 1872.

Applications of Electricity.—Th. du Moncel.—A report by the author on several electrical apparatus constructed and improved by Trouvé. This memoir, illustrated by woodcuts, contains a detailed account of improved galvanic elements, electro-magnetic apparatus for medical use, apparatus for military telegraphy, and apparatus for extracting rifle-balls from wounds.

Report on the Artificial Manure and Works of MM. Dunod and Bougleux.—J. Barral.—The detailed description of the bone-black and artificial manure works situated at Aubervilliers, near Paris; very perfect and excellently working apparatus are in use for condensing the volatile products derived from the carbonisation of bones.

Relation of the Eye and the Ocular Glasses chiefly in Use in Optical Instruments.—F. P. Leroux.—The concluding portion of this essay, illustrated by woodcuts and engravings.

Metalliferous Mines of France, not including Iron Mines.—A. Caillaux.—The conclusion of this essay.

Pharmaceutische Zeitschrift für Russland, No. 12, 1872.

This number contains the following original papers relating to chemistry:—

Testing of Quinine for Adulterations.—J. Biel.—1 part of sulphate of quinine is dissolved in the smallest possible quantity of dilute sulphuric acid; next, 12 parts of ether and excess of ammonia (2 parts) are added, and this mixture, contained in a test-tube, is well shaken up; a white-coloured turbidity and crystalline precipitate indicate the presence of cinchonine. 1 part of sulphate of quinine is rubbed up in a mortar with 20 parts of a decimal solution, at 15°, of Seignette salt (tartrate of potassa and soda; the fluid is next filtered, and, to 5 parts of the filtrate, 1 part of ammonia (sp. gr. = 0·96) is added; a white turbidity of the previously shaken-up liquid indicates the presence of β-chinidine. The residue of the former operation is next treated with 20 parts of a solution of sulphate of soda (1 to 3), and, to 5 parts of the filtered solution, 1 part of ammonia is again added; a white turbidity indicates cinchonidine. 5 c.c. of the cold saturated aqueous solution of pure sulphate of quinine require 4 c.c. of ammonia (sp. gr. = 0·92) to yield a clear solution. 5 c.c. of the aqueous solution of pure sulphate of quinine and 10 per cent of β-sulphate of chinidine gave, with 5 c.c. of ammonia, a strong turbidity, which was got rid of by the addition of 4 c.c. more of ammonia; but, after two minutes, a crystalline precipitate appeared, which required the further addition of 10 c.c. to render the liquid clear. Pure sulphate of quinine, mixed with 10 per cent of cinchonidine sulphate, 5 c.c. of solution, and 5 c.c. of ammonia, yielded an opalescent fluid, which was rendered quite clear by the addition of 3 c.c. of ammonia, but, after five minutes, the precipitate was stronger than before. 5 c.c. of the solution (aqueous) of pure sulphate of quinine and 10 per cent of sulphate of cinchonine yielded, upon the addition of 5 c.c. of ammonia, a strong precipitate, which was hardly dissolved by the addition of 200 c.c. of ammonia.

Detection of Caffeine in Tea-Leaves.—E. Lieventhal.—The description of a rather complicated process of extracting caffeine from tea-leaves by exhaustion of the same with chloroform.

Nos. 13 and 14, 1872.

These numbers only contain original papers relating to pharmacy and pharmacognosy.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, June 24, 1872.

New Mode of Treatment of Scraps of Tin-Plate for the Purpose of Obtaining the Tin Coating from it.—M. Ott.—This paper contains a brief *resumé* of the several methods proposed to recover the metallic tin coating which covers the material known as tin-plate, and a detailed description is given of a process invented by the author; it consists mainly in the methodical treatment of the scraps of tin-plate, first with acid, then with water, then with alkali, and again with acid; the tin is precipitated from its solution by means of metallic zinc, and the spongy metal thus obtained is next molten.

Frigorific Apparatus.—Ch. Tellier.—The description, illustrated by a woodcut, of a peculiarly constructed ice-safe, so arranged as to be a neat piece of useful furniture.

Preparation of Chlorine by a Continuous Process.—Tessié du Motay.—This process is based upon the following reactions:—Peroxide of manganese is first gently heated in a retort, in contact with hydrochloric acid gas; chlorine is evolved, while there is left in the retort chloride of manganese and water—

$$MnO_4 + HCl = 2HO + MnCl + Cl.$$

The chloride of manganese thus obtained is next heated to dull red heat in a fire-clay retort, and decomposed by means of a current of steam into hydrochloric acid and sesquioxide of manganese, but if, along with the steam, there is mixed a sufficient quantity of air or oxygen, there is produced a mixture of chlorine and hydrochloric acid, while peroxide of manganese is regenerated. The hydrochloric acid last mentioned may be converted into chlorine by simply causing air (without any steam at all) to pass at dull red heat over the chloride of manganese—$MnCl + O_2 = MnO_2 + Cl$.

New Process for Bleaching Woollen and Silk Fabrics.—Samal and Beronson.—In order to wash the suint from wool, and the gum from raw silk, the authors apply a more or less concentrated and more or less warm (up to 50°) solution of an alkaline sulphuret or aluminate.

Les Mondes, September 19 and 26, 1872.

These numbers contain no original papers relating to chemistry or collateral subjects.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, May, 1872.

This number contains no original papers relating to chemistry or collateral subjects.

Journal für Gasbeleuchtung und Wasserversorgung, No. 15, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following memoir:—

Report on the Results of the Competition for Water-Meters, as required by a Programme Issued by the Directors of the City of Hamburg Water-Works.—J. A. Samuelson, C.E.—This paper contains valuable information concerning water-meters.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2596. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the manufacture of salt."—Petition recorded August 31, 1872.

2610. J. Noad, Hackney Wick, Middlesex, "Improvements in the manufacture of paper pulp from wood, and in apparatus therefor."—Petition recorded September 2, 1872.

2642. C. W. Torr, Aston, near Birmingham, and J. Johnstone, Birmingham, "Improvements in furnaces for heating and melting metals and metallic alloys."

2644. J. Harvey, Vere, Jamaica, "Improvements in the manufacture of sugar, and in apparatus therefor."—Petitions recorded September 5, 1872.

NOTICES TO PROCEED.

1476. R. C. Menzies, Valleyfield, Midlothian, N.B., and A. E. Davies, Worcester, "Improvements in the manufacture of pulp for paper-making."—Petition recorded May 15, 1872.

2429. T. J. Denne and A. Hentschel, Mile End, Middlesex, "Improved combination of ingredients for treating, preparing, stiffening, and thickening raw, felted, spun, and woven fibres and fabrics, also for use in dyeing and printing such fabrics and fibres."—Petition recorded August 15, 1872.

2454. W. Ferrie. Airdrie, Lanarkshire, N.B., "Improvements in connection with furnaces for smelting iron."—Petition recorded August 17, 1872.

PATENTS SEALED.

835. N. Prada, Trebbin, near Berlin, Prussia, "Improvements in preserving animal substances, and in agents for the purpose."—Partly a communication from P. Toninetti, Trebbin.—Dated March 19, 1872.

865. J. Werner, Mannheim, Baden, Germany, "An improved composition to be used as a substitute for 'brewer's pitch' for lining vats, casks, and tubs, and for other like purposes."—Dated March 21, 1872.

880. H. Hollefreund, Havelberg, Prussia, "Improvements in the treatment of potatoes, maize, corn, millet, and other starch-containing vegetable matters, to obtain saccharine and other products therefrom, and in apparatus employed therein."—Dated March 22, 1872.

908. G. J. Snelus, Dowlais, Glamorganshire, "An improved lining for cupola furnaces, also applicable to the formation of the beds of reverberatory furnaces."—Dated March 25, 1872.

943. A. Beveridge, Leith, N.B., "Improvements in preparing, cleansing, and refining animal fats, and in the means and apparatus employed therefor."—A communication from A. Jurgens, Oss, North Brabant, Holland.—Dated March 30, 1872.

1586. W. R. Lake, Southampton Buildings, London, "Improved processes and apparatus for the extraction of oil and the production of flour from maize."—A communication from H. C. Cavayé, Paris.—Dated May 24, 1872.

2261. W. E. Gill, Salisbury Street, Strand, "Improvements in treating vegetable juices, and in the apparatus and materials to be employed therefor."

2263. G. T. Bousfield, Sutton, Surrey, "Improvements in furnaces for deoxidising iron ores, preparatory to their being worked into wrought iron."—A communication from J. Wilson, Dover, New Jersey, U.S.A.—Dated July 29, 1872.

PATENTS GRANTED IN BRITISH COLONIES.

MAURITIUS.

List of Patents Granted from 1838 to 1872, both inclusive.

1. J. B. Hélie, "Purifying sugar."—Dated November 14, 1838.

2. P. L. W. Terrasson and C. Lieber, "Purifying and filtering cane-juice in the manufacture of sugar."—Dated August 24, 1840.

9. H. A. Hugnin, "Purifying sugar."—Dated February 15, 1845.

12. P. Bernard, "Purifying sugar."—Dated September 4, 1847.

14. W. Bojer, "Manure from night-soil."—Dated November 22, 1849.

18. V. N. Monneron, "Guano, manufactured from sea animals, plants, and other ingredients of this Island,"—Dated February 18, 1853.

19. J. Brandees, "A new process for the manufacture and purifying of sugar, &c."—Dated April 23, 1853.

20. E. Deschiens, "Wine from sugar-cane."—Dated May 27, 1854.

21. L. Wray, "A new process for employing the plant called *Holcus saccharatus* in the manufacture of syrup, molasses, sugar, vinegar, &c., and also for the treatment of the cold raw juice of the said *Holcus saccharatus*, or of any other cold raw saccharine juice, with lime and other suitable substances, and then the filtration of the said juices."—Dated February 7, 1855.

24. G. Garbert, "Disinfecting pulverised charcoal."—Dated March 14, 1856.

25. A. Raynaud, "Spirits of wine distilled from rum and brandy."—Dated August 27, 1856.

26. C. Lieber, "A new process for manufacturing rum."—Dated March 9, 1857.

34. A. P. D'Esmery, "Artificial manure for agricultural purposes more particularly adapted for the cultivation of sugar-canes."—Dated March 25, 1859.

35. A. P. D'Esmery, "A composition to be used as a disinfectant and for the cure of sores."—Dated November 26, 1859.

36. Dr. H. F. Fressanges, "A composition to be used as a disinfecting and deodorising agent."—Dated December 6, 1859.

40. P. Boilesve, "A new method of defecating sugar and other saccharine matters and of refining or rectifying alcohol."—Dated June 9, 1860.

47. F. Martial, "Vermicelli and macaroni."—Dated July 2, 1861.

50. H. I. V. Portal, "A process for purifying the juice of the sugar-cane, and which process consists in a special mode of employing lime for the purpose, and in also employing some carbonate or neutral sulphite."—Dated November 13, 1861.

53. A. Maurel, "Compound gas (in a liquid state) consisting of oil of schist and certain substances combined therewith."—Dated January 31, 1862.

54. C. Molet, "Artificial manure, possessing the same qualities as Peruvian guano."—Dated May 5, 1862.

57. A. Toulorge and P. Maurice, "A new process for manufacturing sugar."—Dated September 16, 1862.

60. Ali-Ben-Sou-Alle, "Paste for the manufacture of paper."—Dated October 24, 1862.

61. F. I. Rivière, "A process for the destruction of the 'borer'."—Dated January 20, 1863.

62. C. Bernard, "A process for the manufacture of spirits."—Dated March 31, 1863.

63. G. Davies, "Improved process for the manufacture of sugar."—Dated April 6, 1863.

66. E. T. and E. B. de Gemini, "An improved process for bleaching and clarifying sugar and other saccharine matters."—Dated June 6, 1863.

69. A. Joly, "Manure by means of hydrated oxide of phenite."—Dated August 16, 1864.

75. A. Rampant, "Improved process for manufacturing sugar."—Dated May 28, 1866.

77. G. Garbert, "Artificial disinfecting and deodorising charcoal."—Dated June 12, 1866.

78. G. Garbert, "A process for preserving and colouring timber by injection of preservative solutions and dyes."—Dated June 12, 1866.

81. A. Robert, "A process for extracting the saccharine particles left in the 'bagasse' (cane hash)."—Dated March 19, 1867.

84. F. I. W. Minchin, "Improved process for extracting the juice from the sugar-cane, beet-root, and other plants."—Dated May 16, 1867.

89. G. d'E. de Charmoy, "Improvement in the mode of manufacturing sugar."—Dated April 18, 1868.

90. A. Robert, "A process for converting syrup sugars and syrup into 'Veson' sugars."—Dated April 18, 1868.

94. Dr. E. Icery, "A process of decoloration and purification of cane-juice by the protosulphite of oxide of calcium."—Dated December 29, 1868.

96. I. G. G. H. Griffiths, "Soap prepared by a combination of subcarbonate of soda and other substances with water and oil."—Dated April 22, 1869.

102. E. Boivin and D. Loiseau, "Improving the manufacture and refining of sugar by using for that purpose a product termed 'saccharate of hydrocarbonate of lime,' obtained by the introduction of carbonic acid into a calcareous saccharine solution."—Dated February 10, 1870.

103. W. O. Giles, "An improved mode of preserving animal and vegetable substances by placing such substances in a heated chamber so as to evaporate their moisture, and afterwards by penetrating such substances with heavy vapours from a retort containing coal-tar oil, resin, or other oleaginous substance capable of being vapourised by the application of heat."—Dated February 21, 1870.

108. G. d'E. de Charmoy, "A new process to disinfect human excreta to be afterwards changed into manure."—Dated November 5, 1870.

111. A. Robert, "An essential improvement in obtaining fine sugar from syrups or molasses."—Dated December 15, 1870.

112. A. Robert, "An essential improvement in the mode of extracting sugar from cane hash."—Dated December 15, 1870.

118. Dr. J. Mailloux, "A process for the defecation and clarification of cane-juice and syrups by means of porcelain clay or kaolin, or hydrated silicate of aluminium."—Dated March 31, 1871.

120. C. A. de Bragard, "A new mode of refining ordinary and low sugars."—Dated June 30, 1871.

121. J. Hall, "A process for the preservation of meats and provisions."—Dated July 25, 1871.

124. G. d'E. de Charmoy, "A chemical compound both to deodorise night-soil and to make the same more effectually applicable as a manure to agricultural purposes."—Dated October 6, 1871.

125. T. Hill, "Saccharine material, called 'saccharum'."—Dated October 17, 1871.

TO CORRESPONDENTS.

A. H. A.—Normandy's "Commercial Analysis" is published by Lockwood and Co., price 9s.

A. M.—Wagner's "Chemical Technology" Is published by J. and A. Churchill, price 25s.

J. R.—Consult "Kerl's Metallurgy," by Crookes and Röhrig, published by Longmans and Co.

J. Baker, T. Fletcher, W. King.—Received with thanks.

THE CHEMICAL NEWS.

Vol. XXVI. No. 672.

THE AMMONIA PROCESS OF WATER ANALYSIS IN INDIA.

By EDWARD NICHOLSON, F.C.S., Assist.-Surg. R.A.

I owe some amends to Messrs. Wanklyn and Chapman for having, some months ago, hastily depreciated their ammonia method of estimating organic matter in water. The best amends I can make is to give an account of the results obtained by the process, both in my own experience and in the published results of other analysts' work. The first specimen of official results I saw were rather wild; whether *grms.* had been misprinted for *milligrms.* I know not, but "albumenoid ammonia 0·1750 grm. per litre" in a good spring-water looks peculiar, There is no appearance of misprint about it, and I attributed the extraordinary amount to the eccentricity of the condensing arrangements in the government apparatus.

I since have had access to the Reports of the Bengal water analyses, and find that in 1869 Dr. Macnamara, Chemical Examiner to Government, and in 1869-70 Dr. Palmer, his substitute, made ammonia examinations of the waters of Calcutta and the neighbourhood; I am thus enabled to compare the results obtained by two successive analysts on the same waters.

I have been able to trace examinations of three or four waters for several successive seasons; peculiarly enough, each examination appears to yield more and more ammonia, though the organic matter by the permanganate does not increase notably.

		Centigrms. per litre.		
		NH_3.	Alb. NH_3.	Oxygen of Permanganate.
Old tank on the glacis of Fort William, supplied by surface drainage*:—	April, 1867.	—	—	0·25
	Jan., 1869.	0·008	0·025	—
	Feb., 1869.	0·007	0·038	—
(After the rains).. ..	Nov., 1869.	0·002	0·052	0·09
	Dec., 1869.	0·009	0·090	0·19
	Jan., 1870.	0·005	0·034	0·16
	Feb., 1870.	0·004	0·098	0·17
New tank on the glacis of Fort William; can be filled from the river Hoogly*:—	Sept., 1866.	—	—	0·18
	April, 1867.	—	—	0·12
(After the rains).. ..	Sept., 1867.	—	—	0·06
	Jan., 1869.	0·006	0·035	—
	Feb., 1869.	0·007	0·051	—
(After the rains).. ..	Nov., 1869.	0·004	0·056	0·09
(Partially re-filled from the river)	15th Dec., 1869.	0·010	0·040	0·31
(Filled)..	20th Dec., 1869.	0·008	0·050	0·12
	Feb., 1870.	0·019	0·084	0·11
	May, 1870.	0·008	0·100	0·07
Hoogly river:—				
At Barrackpore, above Calcutta	Jan., 1869.	0·005	0·008	—
	,, ,,	0·007	0·008	—
At Calcutta ..	Dec., 1869.	0·008	0·013	0·06
	12th Feb., 1870.	0·007	0·022	0·06
	24th ,, ,,	0·012	0·022	0·06

There are considerable discrepancies in the above results; for instance, the new tank water, requiring 0·09 centigrm. of permanganate oxygen, and containing 0·056 centigrm. of albumenoid ammonia, is filled up from a comparatively pure river; the permanganate oxygen increased to 0·31 centigrm., and the albumenoid ammonia decreases somewhat. If, as is likely, the disturbance of the water caused an increase of oxygen to be consumed by oxidisable matter, the albumenoid ammonia should have increased also. With the subsidence of the water, the quantity of permanganate used fell rapidly to the original amount, while the albumenoid ammonia still increased. I can understand, in this case, the results of the permanganate much better than those of the ammonia process.

The increased amount of permanganate required led the Chemical Examiner into a curious error; he says, "fresh water had been pumped in from source which, though less impure in most respects (albumenoid ammonia) contained a loathsome amount of impurity." A few weeks afterwards he finds that the tank was re-filled from the river Hoogly, and examines the river-water with the results given above. I strongly suspect these albumenoid ammonia figures are much less trustworthy than those of the permanganate.

Within the last few days I have received the "Report of the Madras Water Examinations" for the year 1871. One of the analysts, Mr. Harvey, has been for some years assistant to the successive Professors of Chemistry in the Madras Medical College; I know that his work can be relied on as conscientious, and his results will therefore afford a fair criterion. From his connection with the chemical department of the Medical College, he would have access to corks, india-rubber tubing, and such like necessaries for fitting up apparatus, enabling him to work the ammonia process without difficulty.

The details I unfortunately cannot give, owing to the muddle which the compiler or the printer has made of the analyst's figures, 0·06, 0·006, 0·0006, and 0·00006 grm. being evidently interchangeable; the whole report, as far as figures go, is full of mistakes. Mr. Harvey says, of the waters of St. Thomas's Mount:—

"By the permanganate, as well as by the ammonia process, the quantity of organic matter found is remarkably small; and, assuming the albumenoid ammonia obtained to express the purity, or otherwise, of drinking waters, with one exception, none of these waters exceed the standard laid down by Messrs. Wanklyn and Chapman for a pure water, the albumenoid ammonia obtained ranging from 0·03 to 0·08 per million. They may, therefore, be regarded as waters of very great purity, and unquestionably well adapted for drinking and other domestic purposes." However, seven out of twelve of these well-waters are too brackish to be potable.

The Palaveram waters examined by the same analyst were much of the same character. The best well (containing 20 centigrms. of total solids, 2 of which were chlorine, requiring 0·04 centigrm. of permanganate oxygen, and yielding 0·05 centigrm. of albumenoid ammonia) was in a locality used as a rubbish and sweepings depot; it was only 18 feet deep. This shows the little effect of surface pollution on sub-soil water.

The analyst at Rangoon gives figures for the results of the ammonia process, but they are of such a peculiar character that I hardly like to quote them; numbers such as 0·0032 grm. of ammonia and 0·0006 grm. of albumenoid ammonia are common. A good well-water requiring 0·0010 grm. of oxygen is said to yield 0·00470 grm. of ammonia and 0·0040 grm. of albumenoid ammonia.

Three examinations of water from the Rangoon lake, a beautiful piece of clear and pure water with which I am well acquainted, are said to have given the following results:—

	Grm. per litre.		
	(*a.*)	(*b.*)	(*c.*)
Ammonia	·0006	·0012	·0008
Albumenoid ammonia..	·0016	·0014	·0016
Permanganate oxygen	·0010	·0011	·00107

I cannot consider the determination made by the ammonia process at Rangoon as being in any way trustworthy.

The analyst at Secunderabad did not give any results of the ammonia process; and, considering that the apparatus supplied to the analysts consisted of a retort and a clumsy copper condenser that would not condense (without the slightest means of connecting the two), he acted wisely.

* The water of the above tanks is, after filtration, the drinking-water of the European troops in garrison.

For my own part, I made no systematic ammonia examinations until I had got out apparatus of my own; at the end of the year I began the process, and have obtained the following results from various waters:—

Wells.	Centigrms. per litre. Ammonia.	Alb. Ammonia.	Oxygen of Permanganate.
The Dhobies wells, Bangalore; water 6 feet from the ground, percolated from the Ulsoor tank through a gravel bed; 16 wells all communicating:—			
(1). A well not in use, ground clean ..	0·0005	0·005	0·015
(2). A well in use, ground trampled into mud by the bullocks carrying water to the troops; water drawn by leathern buckets..	0·0020	0·008	0·020
(3). A well on the ground now used by washermen; clothes constantly washed close to the well	0·0020	0·026	0·040
A well in Bangalore gaol, conservancy perfect	0·0010	0·006	0·010
A well, very open, water kept low by constant draught; supplies Artillery horse-troughs	0·0060	0·010	0·240
Water from the above well, filtered at barracks; filter receptacle open and not looked after..	0·0030	0·026	0·230
A well, large and open, used solely for supplying barracks, by means of an aqueduct; ground perfectly open, irreproachable, and the well guarded; the water is always yellow, from *humic* organic matters; of excellent quality	0·0030	0·021	0·300
A large open well, with steps; people constantly going down to fill their water-pots, wading for a little distance in the water; water covered with *Conferva crispa*; in great demand	0·0060	0·020	0·060
A well in great use, very muddy all round from trampling of bullocks; ground open, conservancy otherwise good	0·0030	0·024	0·030
Tanks.			
Water supplied to troops from the water-works at Ulsoor tank; the water, before filtration, is opaque with yellow clay; after filtration (through 5 feet of sand) it is clear and good; the conservancy of the tank is very good, but the vegetation is entirely conferval..	0·0020	0·014	0·080
A tank without vegetation, except *Conferva*; greenish coloured water, with much water fleas; water in great demand	0·0070	0·022	0·140
A small tank, in which people are all day wading to fill their water-pots; water turbid and swarming with water-fleas; no vegetation; conservancy good	0·0100	0·043 (1st., 0·046) (2nd., 0·041)	0·080

It is not easy, in the present state of our knowledge, to draw conclusions as to the standards of purity exigible from Indian waters, or as to the interpretation we should give to the figures representing organic impurity. As far as I can see, good waters vary exceedingly; the following standards appear to be approximately applicable:—

Well Waters.	Alb. NH_3.	Permanganate Oxygen.
Standard; good filtering soil; water clear and colourless, not much disturbed in drawing	0·007	0·02
The same, but much disturbed; ground muddy	0·015	0·04
Open reservoir-wells, with vegetation, disturbed by peoples feet, &c.	0·020	0·10
Tank Waters.		
Standard; not much vegetation; well filtered from animalculæ and suspended matters..	0·015	0·10
Much vegetation	0·020	0·30
Little vegetation; much animalculæ	0·025	0·10

Quantities above the standards should lead the analyst to examine how far they may be due to pollution by putrescent or organic matters. No water should be condemned without being judged on the full evidence derived from—

(*a*). Mineral matters compared with those of good waters in the same drainage-basin.

(*b*). Organic matters estimated by ammonia process and the permanganate test.

(*c*). Examination of physical properties.

(*d*). Full inquiry into the condition, past and present, of the drainage-ground.

The seventh well in the above list is an example of a water that would be condemned if the evidence of the organic matter were alone taken. Thorough examination showed that the organic matter must be of humic origin; the water is perfectly wholesome and pleasant.

On the whole, I may say that the ammonia process gives a fairly accurate estimate of the amount of nitrogenised organic matter in the water, but other evidence must be adduced in order to show the origin of the nitrogenised substances. I find that there is a good deal of difficulty in getting rid of the free ammonia, and am disposed to think that much of it properly belongs to the albumenoid ammonia. With regard to the applicability of the process to Indian sanitary requirements, I think that India is too far backwards yet for it, and that it is too delicate to be trusted in the hands of analysts and others who have received no chemical education.

ON A PROBABLE CHEMICAL AND INORGANIC ORIGIN OF THE ATLANTIC OOZE AND THE CHALK.

By THOMAS P. BLUNT, M.A., F.C.S.

A VERY probable and ingenious answer has lately been suggested to the question, "Why is the sea water salt?"—an answer which carries conviction with it, because it shows, by a prior reasoning, that the sea must necessarily contain large quantities of chloride of sodium, or at least of soluble chlorides. The process of reasoning may be stated as follows:—

A constant distillation of pure water is taking place from the enormous surface of the ocean by the solar heat; clouds are formed, which drift in part over the continents, and on coming into contact with the necessary climatic conditions fall as rain; this in its turn filters drop by drop through the soil and forms the springs which overflow and produce the rivers and streams. The water of the latter, however, is no longer pure, but is found on analysis to contain on an average about 0·7 grain of chlorine per gallon,* derived no doubt from the soil, and probably in most cases in combination with sodium. The water thus charged with chlorides reaches the sea, where it is subjected to the concentrating process described above, and so time after time the soil is lixiviated, the chlorides dissolved out of it accumulating in the ocean.

The above theory only requires to be stated to commend itself at once as the most probable and natural explanation of the saltness of the sea, however the latter may be augmented in certain regions by the discharge of brine-springs. But it must be remembered that chlorides are not the only solid contents of spring and river water: for every grain of chlorine present in them, we find on an average from 6 to 8 grains of carbonate of lime; what, then, is the destination of this latter constituent? Clearly, as soon as the carbonic acid, which alone renders it soluble, is dissipated by the sun's heat at the surface of the sea, it will subside in fine particles to the bottom, there forming a "fur" similar to, but less consistent, than the deposit which causes constant annoyance in our steam boilers, and even in the domestic tea-kettle similar to the latter, for its origin and chemical character are the same, but differing in consistence on account of the far more gradual and gentle manner in which it is separated,

* It should be mentioned that *natural* water is here referred to, the writer found 0·8 grain of chlorine in the water of a spring situated in a remote part of the Welsh hills.

which causes it to appear as the fine mud or "ooze" described as coating the lower half of the recovered Atlantic cable.

It is not, of course, denied that the sediment thus produced is largely supplemented by the chalky exuviæ of marine animal life, or that the deposit may not in parts even mainly consist of the latter, but it is maintained that the greater portion of the amorphous "ooze," and of the chalk, which appears now to be identified with it, must necessarily be the product of a purely chemical process of the kind described; otherwise we are at a loss to account for the disposal of the enormous weights of carbonate of lime carried daily into the sea by the rivers.

ON A

NEW PROCESS FOR THE ESTIMATION OF IODINE IN KELP LIQUORS, MINERAL WATERS, &c.

By E. SONSTADT.

The addition of an alkaline permanganate to a liquid containing an iodide in solution, converts the iodide into an iodate, provided sufficient free alkali, or alkaline carbonate is present to prevent liberation of iodine. This fact (which I discovered early in the present year, in the course of investigations having for their object the effecting of improvements in the manufacture of iodate of potassium direct from the mother-liquors of kelp, instead of from iodine, as hitherto practised), I have found very serviceable for the estimation of iodine.

Alkaline solutions of chlorides and bromides are not in the least acted upon by permanganate solution. But neither chlorides, bromides, nor any other salts that ordinarily occur with iodides, interfere with the transformation of iodide into iodate by permanganate. Even organic matter does not interfere, provided the permanganate is added in sufficient excess. The process I adopt consists simply in adding excess of permanganate of potassium to the solution of salts containing iodide, until a slight permanent tint of permanganate colouration remains. The solution is first rendered alkaline, best by addition of caustic soda, to an extent adjusted to the proportion of iodide present; but always so far as to preclude any possibility of the liberation of iodine. The liquid is then filtered, and if it does not already contain a sulphate, a small proportion of a sulphate is added to it. Solution of chloride of barium in excess—but not in much excess—is then added, and the precipitate, after separation from the liquid by filtration and washing, is heated with solution of sulphate of potassium in excess. The filtered solution contains the whole of the iodine originally present in the portion taken for analysis, as iodate of potassium. The quantity of iodic acid may be estimated volumetrically by any of the usual processes; or the mixture of iodate and sulphate may be ignited at a low red heat, and the iodide of potassium remaining be estimated either volumetrically or gravimetrically.

In this process, the transformation of iodide into iodate by permanganate in alkaline solution is *complete*. The precipitation of the iodic acid by a barium salt in presence of a sulphate is *complete*. The decomposition of iodate of barium by heating with solution of sulphate of potassium in excess, is *complete*. By the word "complete," I mean within appreciable limits. That is to say, I have, in the course of many experiments specially devoted to that end, been unable with certainty to detect even a trace of iodine either in a liquid in which an iodide had been transformed into iodate as described, and precipitated, in presence of a sulphate, by chloride of barium; or in the barium precipitate, after heating with sulphate of potassium in excess, filtering, and duly washing.

The severest test that can be applied to a process of this kind, is not to use it upon weighed quantities of an iodide, but to try it upon liquids containing, for the quantity taken, imponderable quantities of an iodide or of an iodate. The experiments that have already been described on sea-water, in my paper "On the Presence of Iodate of Calcium in Sea-water," afford a good illustration. In these experiments, one part of iodate of calcium in a quarter million parts of liquid, sufficed, in such a quantity of the liquid as did not contain a ponderable quantity of iodine, to give measurable iodine reactions in the precipitate thrown down by chloride of barium. And yet, if we suppose the whole of the iodine in sea-water to exist as iodate of barium, after addition of a barium salt, the sea-water would contain only about 1 per cent of a saturated solution of that salt. I at first supposed this very complete precipitation of iodic acid by barium salt in sea-water to be owing to some element contained in my chloride of barium, that formed an iodate much less soluble than any that had been described. I therefore took a considerable quantity of the same chloride of barium that had been used in these experiments, and precipitated it fractionally by solution of pure iodate of potassium at three times. All the precipitates had sensibly the same degree of solubility in water. Iodate of barium is remarkable, however, in this; that it dissolves with such extreme slowness in even boiling water, that it is the work of days with the aid of heat, to get a really saturated solution. The water used in these experiments had been carefully distilled off permanganate of potassium, since water not perfectly free from organic matter cannot be trusted for solubility determinations of the iodates. The results I obtained agreed nearly enough with the published determinations of the solubility of iodate of barium to convince me that the complete precipitation of iodic acid in presence of sulphuric acid by a barium salt, is due to surface attraction, between sulphate of barium formed in the liquid, and nascent iodate of barium. If we consider how many square metres of surface a single gramme of so finely divided a precipitate as sulphate of barium usually is must present, the property that this salt is supposed to enjoy above all others, of carrying down with it other more soluble salts, ceases to appear inexplicable. Yet this power certainly is not exercised solely in obedience to the degree of solubility of the salt so pulled, by mechanical attraction, as it were, out of solution. A *colloid* salt and a *crystalloid* salt seem to have no pulling power upon one another; and crystalline salts apparently are subject to such influence under some law connected with the complexity of their crystalline form. Again, two colloid salts, as the hydrates of alumina and of ferric oxide, scarcely admit of complete separation.

FLUORESCENCE.

In a series of papers to *Poggendorff's Annalen*, Herr Hagenbach describes extensive researches on this subject. We propose here to give a brief statement of his results.

To the question whether all the rays of the spectrum are capable of exciting fluorescence, he considers an affirmative answer may be given. As to excepting the red rays before B, from which fluorescence was not obtained, it is to be considered, that since fluorescent light is always less refrangible than the exciting light, fluorescence excited by the extreme red may not be visible by our eyes.

As to the extent of fluorescence in the spectrum, there are cases (as that of fluor-spar), in which it only begins in the violet after G; and others (as chlorophyll) in which it is spread over the entire spectrum. No fluorescent substance was met with which did not fluoresce in the neighbourhood of the line H.

The maxima of the fluorescence were very various.

From 7 maxima, *e.g.* in chlorophyll solution, to 1 maximum (so to call it) in ether and sulphuric acid. In some cases the difference between maxima and minima was very perceptible, in others not.

Stokes's law, that where rays excite fluorescence a corresponding absorption takes place, was verified. The absorption spectrum could thus frequently serve to determine more accurately the maxima of fluorescence. But it is frequently found that absorption of light occurs without corresponding fluorescence. Herr Hagenbach observed, *e.g.*, in a water solution of litmus an absorption additional to that corresponding to the fluorescence. This is probably explained, he thinks, by the mixture of a fluorescent with a non-fluorescent substance.

As to the spectrum of fluorescent light, there is also great variety in this. The spectrum with least extent was that of chlorophyll; while those of fluor-spar and miomelanic acid were among the most extended. With regard to "intermittence" in the light intensity, we have various cases. From 8 maxima in nitrate of urea, 6 in bichloride of anthracene and petroleum, down to 1 maximum, and so no intermittence, in naphthalene, red nitrate of chrysanilin, and others. The difference of brightness between maxima and minima is, as in the former case, well marked in some substances, and in others not.

Is there any correspondence between the intermittence in the fluorescence of the spectrum (the fluorescent spectrum) and that in the fluorescence spectrum? In some cases there appeared to be such, as *e.g.* in extract of soot, which gave 5 maxima in both spectra. But other cases showed there is no necessary connexion between the two. Thus the solution of fresh chlorophyll gave 7 maxima in one spectrum and only 2 in the other. Naphthalene showed 3 maxima in one spectrum, and no intermittence at all in the other. Nitrate of uran, giving 8 maxima in the fluorescence spectrum, gave no intermittence in the ordinary spectrum.

Is the intermittence of fluorescence in the one case or the other to be explained by mixture of fluorescent substances? This is Von Pierre's hypothesis. While it is possible to produce intermittence artificially through mixture, Herr Hagenbach considers that in many instances the hypothesis is improbable. Then in the case of a fresh solution of chlorophyll giving intermittence (which, it is said, arises from the mixture of various different materials), it would at least be a singular thing that in all kinds of plants containing chlorophyll, the materials were mixed in like proportions, and that all the materials which by the different rays were excited to fluorescence should give the same fluorescence spectrum.

Stokes's law that in fluorescence light the rays called forth are never more refrangible than the exciting rays, was found in every instance to hold good.

Herr Hagenbach also verified Von Pierre's propositions as to the connexion between the exciting and the excited rays.

With reference to the influence of the solvent on the character of the fluorescence, it was found, in many cases, that do change in effect arose from changing the solvent; in other cases, the maxima of the fluorescence or of the fluorescence spectrum, were displaced. Several instances are given. Thus in ether solution of amide of phthalic acid, the beginning and maximum of fluorescence are nearer the violet end than in the alcohol solution. The same thing is found in similar solutions of chlorophyll.

Kraus made the observation, that the thicker a solution is, the further are absorption-bands moved towards the red end of the spectrum. As fluorescence maxima and absorption-bands correspond, Herr Hagenbach considers his experiments may serve to confirm Kraus's view; but that the data as to the relation between fluorescence and absorption are as yet somewhat insufficient. Cases of displacement (through change of solvent) in the fluorescence spectrum are further given; and the author asks whether a displacement of the maxima of fluorescence is always accompanied by a displacement in the fluorescence spectrum. In the ether and alcohol solutions of amide of phthalic acid, the ether and alum solutions of purpurin, and other instances, this was found to take place; but in others, as a solution of extract of soot with oil of turpentine, compared with a solution of the same substance in ether or alcohol, it did not.

The question whether fluorescence in the solid state implies fluorescence in a state of solution, and *vice versa*, must be answered differently for different substances.

Some substances fluoresce in the solid state, and not at all in solution; some greatly in the one state, little in the other; some show strong fluorescence in both states; some fluoresce little in the solid state, and greatly in solution; some fluoresce only in solution.

Herr Hagenbach considers it probable that phosphorescence and fluorescence are phenomena differing in degree only, not in kind; though further data are necessary to the elucidation of this. He finds much similarity between the fluorescence spectra and many of the spectra of phosphorescent substances.

A. B. M.

ON THE CONCENTRATION OF SULPHURIC ACID.

By R. HASENCLEVER.

It is well known that the sulphuric acid prepared in the leaden chambers is first concentrated up to a sp. gr. of 2·7 in leaden apparatus; while the further concentration to 66° Baumé (sp. gr. 1·85) is carried on in vessels made of glass or platinum. All the leaden apparatus used for the purpose of concentrating the chamber acid to 60° Baumé (sp. gr. 1·7), are more or less acted upon by the acid; and it is of great importance to be well acquainted with the behaviour of the lead with acid at different temperatures. Experiments made in the chemical laboratory of the Chemical Works, Rhenania, proved that when pure sulphuric acid was evaporated in a vessel made of doubly refined lead, sulphurous acid was given off at a temperature of 165° to 178°, and at a degree of concentration of the acid at 57° Baumé (1·659 sp. gr.), there was a distinct smell of sulphuretted hydrogen. While at 180°, and with an acid at 58° Baumé (1·678 sp. gr.), a very strong decomposition of the acid, attended by violent foaming and deposition of sulphur, commenced. The same phenomena have been observed on the large scale; by the overheating of the sulphuric acid so much gas was suddenly evolved that the liquid contained in the leaden pan boiled violently, while sulphurous and hydrosulphuric acid, as well as sulphur, were set free simultaneously. Sulphuret of arsenic was formed in acid contaminated with arsenic.

It has often been thought that these phenomena were due to impurity of the lead, and that metal was frequently analysed by the sulphuric acid makers, as well as by lead merchants, who were blamed for the corrosion of the leaden pans; but it appears that only trifling impurities were detected in the lead. At the chemical works above named it became customary to use a thermometer, and by that means the corrosion of the leaden pans due to overheating of the acid was prevented. Some few weeks ago, however, a brisk evolution of gas was observed in one of the leaden pans, while the acid contained therein was only at a temperature of 135°. The gas evolved was found to be hydrogen, while the lead of which the pan was made was moderately pure. Since it was known to me that the complaints of the rapid corrosion of the leaden pans have increased since the lead is de-silvered with zinc, it occurred to me that a pure soft lead obtained according to the new method, would be more apt to become corroded. I procured a sample of Mechernich lead (a locality in

Prussia where lead ore is largely smelted), the composition of which was percentically—Lead, 99·9941; silver, 0·0006; copper, 0·0008; antimony, 0·004; iron, 0·0005. This lead was put into a flask, and pure sulphuric acid of 54° Baumé (sp. gr. 1·601) poured over it. On being heated to 40°, small gas bubbles were seen to be emitted from the lead, and at 80° a distinct and continuous, though not a brisk, evolution of gas took place, which increased with an increase of temperature. The gases evolved were hydrogen and sulphuretted hydrogen. A portion of this same sample of lead was molten and mixed with some antimony, and after cooling, the sample was again submitted to the same treatment with pure sulphuric acid at 54° Baumé. A very faint evolution of gas commenced when the acid was heated up to 85°, and even at 100° this evolution of gas was hardly stronger, but at 140° the evolution of the gases became rather more brisk.

From the results of a series of experiments I am inclined to believe that pure and soft lead does not resist the action of hot sulphuric acid so well as the harder kinds of lead; a fact which is of practical bearing and deserves to be further studied by experiments. As regards the apparatus more commonly in use for concentrating sulphuric acid (chamber acid) these are—

(1). Evaporating pans made of sheet-lead placed on plates of cast-iron, below which the fire is kindled (direct heating).
(2). Leaden pans heated by means of a reverberatory furnace (the flame playing over the surface of the acid), the edges of the leaden pans being hollow and filled with cold water in order to prevent the melting of the lead.
(3). Concentration by means of high-pressure steam.
(4). Concentration by means of heated sulphurous acid gas.

As regards the first mentioned apparatus, it is absolutely necessary to control the evaporation by means of a thermometer in order to prevent the overheating of the acid, and consequently the corrosion of the lead. When the workman in charge of the operation of evaporating takes due care, and makes frequent use of the thermometer, these leaden pans may last a long time, although they will require frequent repairs, and are not to be recommended for economy in the consumption of fuel and loss of acid. The reverberatory furnace for evaporating acid is an English invention, and has been introduced into Germany some few years since at Lüneburg. These furnaces do not consume much fuel, require little repair, but their use is attended with the inconvenience that the acid becomes readily overheated; while with the smoke and other products of the combustion, much sulphuric acid is carried off. On this account the use of this apparatus has been discontinued in many works. The first suggestion of the application of indirect high-pressure steam to concentrate sulphuric acid (chamber acid) has been made by Carlier, the technical manager of the Chemical Works of F. Curtius, at Duisburg (Rhenish-Prussia). After a series of preliminary trials, the chamber acid, at the works just mentioned, is now evaporated in the following manner:—The acid is poured into a wooden lead-lined tank 4 metres in length and width. On the bottom of this tank are placed two coils of leaden pipes 45 metres long, 0·03 metre internal diameter, and 0·007 metre thickness of lead. Through these coils high pressure steam is forced as long as the tank is filled with acid. In order to cause the water of condensation in the tubes to run off freely, the bottom of the tank is made in the shape of a cut-down pyramid: the depth of the tank in the centre being 0·60 metre, and at the sides 0·30 metre. The ends of the tubes (outlet and inlet) communicate with a steam boiler placed at a lower level than the tank, stopcocks being fitted to the inlet and outlet of the leaden pipes (coil). The inlet of the coil communicates with the steam-boiler below the water-level therein; while the outlet of the coil communicates with the steam-chest, thus affording an opportunity for the condensed water to flow back into the boiler.

The operation of concentrating the chamber acid is intermittent. The tank having been filled with acid at 1·5 sp. gr., the circulation of steam is kept up until the sp. gr. of the acid has increased to 1·7; this point having been reached, the hot acid is transferred to a wooden lead-lined tank, at the bottom of which is placed a serpentine coil of leaden pipes through which the chamber acid is made to pass before flowing into the concentration tank, so that the latter is filled with acid which is already warm.

In an apparatus of the size and dimensions alluded to, 5 tons of chamber acid are concentrated to 1·7 sp. gr. in 24 hours. The steam in the boiler is at a pressure of 3 atmospheres (= 45 lbs. to the square inch = 135·1° temperature); the quantity of fuel consumed amounts to 9 per cent of the acid concentrated. As regards the feeding of the boiler, this need only be intermittently done by the aid of a force-pump (donkey engine with pump), because the regular supply of water is derived from the condensed steam. It is advisable to construct at a short distance from the top of the tank a wooden hood, so that in the event of any part of the leaden coil placed at the bottom of the concentration tank bursting, the hot acid while being thrown about does no injury.

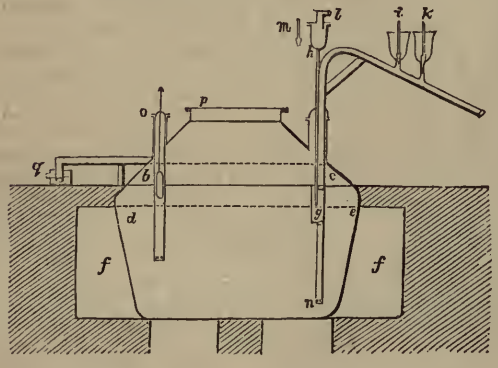
This method of concentrating chamber acid is in every respect superior to the other plans. The lower temperature prevents volatilisation of acid, which is also not contaminated with soot, dust of ash, and smoke, while the expense is, lastly, considerably less. In many parts of Germany this method of concentrating chamber acid has been introduced.

The hot gases of the pyrites burners are often applied for the purpose of concentrating chamber acid. Sometimes leaden pans are placed on the top of the kilns; or, again, the hot sulphurous acid gas is conveyed into a leaden tower lined with bricks. As regards the placing of leaden pans on the top of the pyrites kilns, this plan is attended with inconvenience, for if the pans become leaky, the whole process of sulphuric acid making has to be suspended, while the acid finding its way into the pyrites burners destroys them. It is therefore better to place the concentration pan on a channel situated between the sulphuric acid chambers and the kilns; so that the manufacture of acid is not discontinued when repairs to the leaden pans are required.

A more perfect and greatly improved application of the hot sulphurous acid gas issuing from the pyrites kilns is made in the so-called Glover's towers, a contrivance frequently employed in England, and fully described in the second number of *Dingler's Polytechnisches Journal* for August, 1871, by Lunge. By the direct action of the heated kiln gases upon the sulphuric acid, evaporation ensues; the sulphurous acid gas is strongly cooled down before it enters the leaden chambers; the sulphuric acid and steam which are volatilised also enter the chambers, so that no loss of acid ensues; while, at the same time, the steam supply to the leaden chambers can be diminished. The sulphuric acid obtained by this method of concentrating chamber acid is not quite free from sulphurous acid, a point to be taken into consideration for certain applications of the acid, in which I found 0·7 grm. of SO_2 to the litre. It should be further mentioned that, when the Glover system is applied, there cannot be simultaneously applied a contrivance to arrest the dust and small particles of partly burnt pyrites carried off along with the sulphurous acid, because by the application of such contrivance the sulphurous acid gas would be too much cooled down to be fit for evaporating purposes, and as a consequence the dust would contaminate the acid, rendering it ferruginous. For the purposes, however, of sulphate of soda making, and for dissolving coprolites and other native phosphates, the acid just alluded to is quite pure enough. At my suggestion, a Glover concentration tower has been constructed at the Hautmont

Chemical Works; the results obtained by working it are very satisfactory, and the quantity of iron in the acid only amounts to 0·05 per cent.

As regards the further concentration of the sulphuric acid at 1·7 to 1·85, this is now generally effected in Germany in platinum vessels, the price of which has been brought down to from £48 to £30 per kilo. The construction and mode of operating with platinum vessels is well enough known, but I give here the description of a syphon apparatus which has been made according to my instructions by Messrs. Demontis and Quenessen, at Paris. The mode of construction of this syphon may be inferred by inspection of the woodcut; the contrivance is arranged to prevent the acid in the platinum vessel sinking below a certain level. This arrangement of the syphon apparatus would not be needed if the workman in charge of the concentration operation would pay proper attention to the position of the float; but in actual practice this is not always done, and hence it happens that more acid is withdrawn by the syphon than flows into the platinum still, so that the level of the acid in the same sinks below the line *d e*; in that case, the platinum becomes, or is liable to become, over-heated by the direct action of the heat in the flue, *f*, and as a consequence the metal becomes cracked, especially if, while red-hot, it is brought into



contact with cold acid carelessly poured or admitted into the still. In order to prevent this inconvenience, there has been fitted to the syphon a small tube, *g h*, the lower opening of which reaches just to the lowest admissible level of the acid in the still. When the level of the fluid in the still is above *d e*, the opening, *g*, is closed, and the syphon acts in the usual manner; but, as soon as the level of the acid sinks below *d e*, the syphon sucks air at *g*, and the further action of it is at once stopped. By this contrivance, the possibility of withdrawing from the platinum still so much acid as to expose the metal of the still to the fierceness of the heat of the flue is presented; and, in order to make the syphon act again (of course, after sufficient acid has been run into the still, and been sufficiently concentrated), the workman has to pour strong acid into the cups *i* or *k*. In case it might be necessary to completely empty the still, the lid, *l*, is taken off, the plug, *m*, is put into *h*; after which, by means of the syphon, the acid may be withdrawn from the still as far as *n* (that is to say, a few millimetres' distance from the bottom). If, by carelessness, the workman should run into the still more acid than is carried off by the syphon, the liquid would run over at *o* and *p*; but, by means of the contrivance *q* (an overflow pipe), this may be prevented, and by the arrangements alluded to it becomes possible to keep the level of the acid in the still within proper limits for working the apparatus almost automatically.

The specific gravities, corresponding to degrees Baumé, have been quoted from Dr. O. A. Ziurek's work, "Technologische Tabellen und Notizen.—*Ber. d. Deutsch. Chem. Gesell. zu Berlin.*

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Annual Meeting, April 30th, 1872.

E. W. Binney, F.R.S., F.G.S., President, in the Chair.

The Report of the Council was read by one of the Secretaries.

The following gentlemen were elected Officers of the Society and Members of Council for the ensuing year:—

President—James Prescott Joule, D.C.L., LL.D., F.R.S., F.C.S., &c.

Vice-Presidents—Edward William Binney, F.R.S., F.G.S.; Edward Schunck, Ph.D., F.R.S., F.C.S.; Robert Angus Smith, Ph.D., F.R.S., F.C.S., &c.; Rev. William Gaskell, M.A.

Secretaries—Henry Enfield Roscoe, B.A., Ph.D., F.R.S., F.C.S., &c.; Joseph Baxendell, F.R.A.S.

Treasurer—Thomas Carrick.

Librarian—Charles Bailey.

Other Members of the Council—Peter Spence, F.C.S., M.S.A.; Henry Wilde; Robert Dukinfield Darbishire, B.A., F.G.S.; Osborne Reynolds, M.A.; William Boyd Dawkins, M.A., F.R.S., F.G.S.; Balfour Stewart, LL.D., F.R.S.

"*On Arsenic from Alkali Works*," by H. A. Smith, F.C.S. Communicated by Prof. H. E. Roscoe, F.R.S.

Some time ago the author laid before the Society the results of several analyses of the amounts of arsenic contained in different species of pyrites, and in several of the products in the manufacture of which the acid was employed. At that time he carried his analyses as far as the carbonate of soda, in which no arsenic was found. The present paper is supplementary to the former, and he now endeavours to show that not only does the arsenic remain in the various products of alkali manufacture, but even escapes to the atmosphere.

When the salt used for the production of hydrochloric acid is treated with sulphuric acid, containing arsenic, the arsenic present becomes converted into the trichloride. This compound is said to be completely decomposed by contact with water, so that, after passing along with hydrochloric acid gas through the condensing towers, it would scarcely be expected that any traces of the arsenic originally present would be found in the escaping gas. The author finds this, however, to be the case. A considerable quantity of the arsenic trichloride escapes the action of the water in the condensing towers, and passes, along with a very small proportion of the hydrochloric acid gas, to the chimney.

A deposit found in the flue, about 20 feet long, leading from the salt-cake furnace to the condensing towers, the coke contained in the towers themselves, the gas in the flue leading to the chimney, and the smoke escaping to the chimney, were all submitted to analysis, and were all found to contain arsenic.

The results are gathered together in the following tables:—

Table I.

Deposit in Flue leading from Salt-Cake Furnace to Condensing Tower.

	Arsenic Trioxide per cent.
Mean of 9 analyses	= 43·434

The total numbers in this case were found to agree very closely, varying only from 39 per cent to 47·7 per cent. This flue had been working for some years.

Table II.

Coke from Condensing Towers.

	Arsenic Trioxide per cent.
Mean of 3 analyses	= 2·886

In this case 10 lbs. of coke was used for each analysis, and was digested well, first with distilled water, and then with pure hydrochloric acid. The towers had been in use for about a year.

TABLE III.

Air in Flue leading from Condensing Tower to Chimney.

Amount of air taken for each analysis = 500 cubic feet.
Amount of air passing = 31·722 cubic feet per hour.
The mean of 12 analyses is here given.

Arsenic Trioxide per 1000 cubic feet.	Arsenic Trioxide per hour.	Arsenic Trioxide per day.
Grains.	Grains.	Grains.
0·158	5·012	115·134

The arsenic will probably escape either as arsenious acid or as arsenic trichloride. If as the latter, it may be decomposed, on coming in contact with the atmospheric moisture, into arsenious and hydrochloric acid—

$$(2AsCl_3+3H_2O=As_2O_3+6HCl).$$

TABLE IV.

Specimens of Air, taken 10 feet from Bottom of Chimney.

Amount of air taken for each analysis = 500 cubic feet.

	Arsenic Trioxide per 1000 cubic feet.
Mean of 9 analyses	= 0·086

The author did not know the amount of air passing in the chimney, so he only calculated the amount of arsenic trioxide in grains per 1000 cubic feet.

The method employed for collecting the arsenic trioxide contained in the last two tables was very simple. The air was drawn through three bottles, containing respectively water, hydrochloric acid, and nitrate of silver. The gas was allowed to bubble very slowly through the solutions. The bottles containing them were capable of holding 40 ounces, and were filled about half full.

The idea of arsenic being present in the atmosphere surrounding chemical works is by no means new. The fact of its existence in large amounts in the ore from which the greater proportion of our vitriol is made leads one to suppose that it must find its way into the atmosphere at one place or another, but the author believes that this is the first time the comparative amounts have been brought forward.

"*On Animal Life in Water containing Free Acids*," by H. A. SMITH, F.C.S. Communicated by Prof. ROSCOE, F.R.S.

At a time when so much is being written concerning animal life, its origin, and the conditions under which it can exist, it was thought it might be interesting to find out to what extent it was influenced by the presence of free acid in the water in which it existed, and also to see to what extent free acid prevented its origination.

The animals upon which the experiments were tried were the rotifers (*Rotifer vulgaris*).

A certain amount of air was washed with distilled water, and life allowed to originate in the solution, so that it could be seen at once what influence the amount of acid usually found in air had upon the life.

As a rule it required five days to bring the rotifers to perfection. The method of experiment was very simple. After animal life had been procured in the solution, a known amount of the various acids used was then added, and allowed to stand one day: this was repeated till enough had been added to destroy life.

The results of these experiments are embodied in the following tables:—

TABLE I.

Sulphuric Acid added.

Time allowed to stand.	Total Acidity.	Remarks.
Days.	Grms. per Litre.	
5	0·065	Animal life very abundant. Rotifers in very active condition.
6	0·084	No perceptible difference in appearance of life.
7	0·097	Brownish shade evident in water. Want of clearness in portion examined. Small "clots" of vegetable matter visible. Rotifers languid, seemingly disinclined to move.
8	0·153	Life continued for about an hour; all traces then disappeared. The water presented the appearance of being filled with decomposing and decaying organic matter, which was floating about in "shreds."

TABLE II.

Hydrochloric Acid added.

Time allowed to stand.	Total Acidity.	Remarks.
Days.	Grms. per Litre.	
5	0·0085	Same as in Table I.
6	0·0109	No perceptible difference in the appearance of solution.
7	0·0180	No difference observable.
8	0·0190	Life almost immediately extinct. Fluid still clear. Bodies of rotifers seen floating in it, but of a dull opal-like colour, and being rapidly acted upon by the acid, seemingly becoming "shredded."

TABLE III.

Sulphurous Acid added.

Time allowed to stand.	Total Acidity.	Remarks.
Days.	Grms. per Litre.	
5	—	Life very abundant.
6	0·002	Rotifers more active, causing great disturbance in liquid.
7	0·004	Life sluggish. Rotifers not inclined to move.
8	0·010	After 3 hours all life extinct. No obvious action on the bodies of animals.

It is very interesting to compare these three tables. The order of deleterious influence on animal life being first sulphuric, then hydrochloric, and sulphurous acids in order, the action of the two latter being much more distinctly marked than the action of the former.

In making observations on the amount of free acid required to prevent origination of life, it is found that the order of acid is the same as above, but that the line is much more sharply drawn.

TABLE IV.

Experiments on the Amount of Free Acid contained in Water in which Animal Life can originate.—Sulphuric Acid added.

Time allowed to stand.	Total Acidity.	Remarks.
Days.	Grms. per Litre.	
8	0·070	Life abundant.
20	0·074	Little or no life.
26	0·080	No life.

TABLE V.

Hydrochloric Acid added.

Time allowed to stand.	Total Acidity.	Remarks.
Days.	Grms. per Litre.	
5	0·0085	Life abundant.
8	0·0090	No life.

Water acidified with 0·0025 grm. sulphurous acid per litre was allowed to stand exactly under the same conditions as the former, to see if life could originate in water containing that amount of acidity, but after standing twenty-one days no life was visible.

It is interesting to notice, in these last two tables and the remark on sulphurous acid, the sharp line of demarcation between the amount of acid contained in water in which life can originate and that which totally prevents origination.

In the case of sulphuric acid we find that the small amount of 0·010 grm. per litre, in addition to the ordinary acidity, completely prevents it, whilst in the case of hydrochloric acid 0·005 grm. per litre is sufficient. In the case of sulphurous acid the author could not get life to originate in water containing any of that acid.

CORRESPONDENCE.

NEW PROCESSES FOR ANALYSING COMPOUND ETHERS.

To the Editor of the Chemical News.

Sir,—Dr. Dupré's letter of last week calls for reply. I perceive that he does not lay claim to the method of dealing with fats by means of an application of Erlenmeyer's process with hydriodic acid, whereby iodide of isopropyl is formed; but that he claims to have described the process of decomposing the ethers with alkali, and subsequently estimating the alcohol set free. This he claims to have done in his paper on Wines, published in the year 1867.

I think most chemists will agree with me that in the year 1867, as at the present time, there could be no originality in the abstract statement that compound ethers admit of having the alcohol, which they yield to alkalies, measured or weighed. Doubtless original papers by chemists contain such a statement, and most probably it has been made in chemical lectures, and even in answers by students to examination papers. In 1867, as at present, all that was open to a chemist was to *remind* his brethren of the abstract possibility of such a process, and to point out how to do it and the advantages of resorting to it. Among these advantages I maintain that it is eminently practicable, and capable of yielding very accurate results. As I said in Brighton, I believe that in point of accuracy it will rank with the very best chemical determinations. Notoriously it is not in general use among chemists who are engaged in researches to which it is applicable, and my object in bringing it forward was to induce chemists to use it.

I hope Dr. Dupré will not be offended at being told that, whatever the merits of his paper on wines may be, it has neither induced chemists to adopt the process in question nor was it calculated to do so. Curiously enough, the volatile ethers in wine do not admit of determination by this process. A volatile ether, mixed with several hundred times its weight of alcohol, as occurs in wine, is not under suitable conditions for a determination of the alcohol furnished by decomposing it with alkali; and chemists trying to make such a determination would find themselves exposed to the risk of having the error of experiment greater than the total quantity to be determined. (Unfortunately the evil precedent of a very distinguished chemist has rendered abortive analyses of this description not altogether unfamiliar in England).

In Dr. Dupré's paper I find that he determined the acid of volatile ethers by the usual process, but not a single instance of his having determined the alcohol of a volatile ether; neither can I find any directions for making such determinations, and I will add that it is creditable to Dr. Dupré that he has given none. The non-volatile ethers in wine Dr. Dupré has indeed analysed by measurement of the alcohol, instead of by the usual process of measuring the acid; but, curiously enough, his experiments on the non-volatile ethers of wine illustrate not the ease and accuracy of the method in question, but the difficulties with which it is beset in exceptional cases. He tells us that the alcohol was too weak to be submitted to the ordinary method of measurement by its specific gravity, and that he had to resort to titrations founded on the method of limited oxidation.

If, when I read my paper in Brighton, I had made a reference to Dr. Dupré's work on Wine, it would have been proper for me to have told the chemical section that —notwithstanding the circumstance that the volatile ethers in wine do not admit of being dealt with by the new process, and notwithstanding the difficulties which Dr. Dupré had found in dealing with the fixed ethers in wine by the precess—still, under ordinary circumstances, it is practicable, easy, and accurate, not only in the instance of the fixed ethers, but also of the volatile ethers. —I am, &c.,

J. Alfred Wanklyn.

RED COLOUR SOMETIMES OBSERVED IN WHITE-LEAD.

To the Editor of the Chemical News.

Sir,—In your "Chemical Notices from Foreign Sources" (vol. xxvi., p. 35), you quoted with well-deserved commendation the results of the labours of Messrs. A. Bannow and G. Krämer upon the red colouration sometimes observed in white-lead. Having procured the original communication and carefully considered the experiments these gentlemen have made, although admiring the industry and ability displayed, I must entirely dissent from their conclusions. I also regret that my contribution to the *Philosophical Magazine* in May, 1869, upon this subject appears to have escaped their notice.

My results, which were procured with all the advantages of experiments in a large manufactory, led most decidedly to the conclusion that silver in certain quantities, commencing at about 0·002 per cent, imparts a uniform pink colour to white-lead corrosions. This conclusion accords completely with practical results, and its truth may be readily tested. Provided the sample of commercial soft lead is free from antimony, and that it contains 0·005 per cent of silver, the corrosion will certainly be pink. The depth of the colour is influenced by the character of the corrosion. In a hard flaky corrosion the colour is worse; where the corrosion is swelled and soft the tint is naturally less, owing to the fine particles of silver being spread over a larger surface.

I have made synthetic experiments as follows:—A sample of lead which had repeatedly produced good white corrosions was melted, and a small portion of pure silver added. On submitting these samples to the corroding action in the stacks, only red-tinted corrosions could be obtained, no matter in what position of the stacks they were placed. The addition of antimony again will produce a dull purple-coloured corrosion; but, upon re-oxidising the antimony, the next corrosion will reproduce the pink colour.

Of the samples of lead submitted to experiment by Messrs. Bannow and Krämer, only No. 5, in my estimation, has sufficient silver to produce the tint in a marked degree; but traces of the colour may be often observed close to the core of uncorroded lead, when the bulk of the corrosion is of a fair white colour.

I ought to add that for some time I was convinced this red colour was due to cuprous oxide, and, indeed, I published this opinion in 1862. Subsequently, after refining a large quantity of lead by the zinc process, I had at command a quantity of lead containing only a trace of copper and other metals, but still retaining about 0·005

per cent of silver. I found I could obtain with this lead nothing but pink-coloured white-lead.—I am, &c.,

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46, High Street, Sheffield.

CONSTITUTION OF MATTER.

To the Editor of the Chemical News.

Sir,—Without commenting upon Mr. Kingzett's paper, permit me to draw his attention to two points, the inaccuracy of which does not strengthen his illustrations respecting the atomic and molecular influence exerted by the various cosmic forces. The radical methyl is not CH_3, but is C_2H_6. There is no proof whatever that methyl and ethyl hydride are not identical bodies. Their reactions are identical; their specific gravity, solubility, &c., are practically identical, and they yield the same dichlor. substitution product. Their mode of formation is sometimes in favour of the one view, sometimes of the other. Schlorlemmer's experiments offer proof in the same direction.

It is therefore not correct to say, that "from the radical methyl we can produce its compounds, but we cannot produce them from ethyl hydride."

Again, propylic alcohol has *not* the same composition, and is *not* isomeric with acetone: it is not surprising, therefore, that they should possess dissimilar properties.—I am, &c.,

J. W.

CONSTITUTION OF MATTER.

To the Editor of the Chemical News.

Sir,—In his paper on the "Constitution of Matter" (Chemical News, vol. xxvi., p. 138), Mr. Kingzett says—"If by some operations a certain substance had its properties changed, the question arises, Should it still be regarded as the original substance?" Mr. Kingzett thinks not. What a glorious chance would this afford to amateur chemists who wish to distinguish themselves by the discovery of new substances! Let them take a beaker of pure water at about 0° C., and heat it gradually to 100°, marking down in their note-book the discovery of a new substance for every intermediate degree.

"That many simple bodies have properties very much like those of each other," as exemplified by bromine, chlorine, and iodine, is no proof of the mono-elemental theory of matter, but (observing the relations between the gradation of properties and the gradation of atomic weights) is strongly in support of the atomic theory, which stands opposed to the theory advocated by Mr. Kingzett.

"See," says Mr. K., "how the metallic bodies fade into the non-metallic bodies, and animal into vegetable life." Such an abstract idea as this is of no use in a discussion on physical or chemical science, its relation to the subject being too ill-defined to serve as the basis of a thought.

Mr. Kingzett advances the idea that "all the simple known and unknown substances . . . are composed of the same, and only elemental matter, each being differently acted upon by natural molecular forces." We have no doubt that the only difference between the so-called elements (hydrogen, oxygen, &c.) is the difference of their respective atomic weights, and *of course* corresponding atomic sizes. And, if this is the case, the ultimate atoms themselves (whether of hydrogen, oxygen, or of any other element) must be all of the same, and only elemental matter, because, not being themselves composed of atoms, no difference in the nature of their substance can exist. Thus far we agree with the mono-elemental theory.

Mr. K., having this theory firmly fixed in his mind, has, through it, fallen into a great error. He supposes that all the so-called elements, being composed of only one primordial matter, there is no chemical difference between them but which may be reconciled by the withdrawal or alteration of the forces. But, inasmuch as the withdrawal of the forces cannot alter the atomic sizes, the chemical nature of the elemental bodies cannot thus be altered.

"On this view of the matter," says Mr. Kingzett, "a compound would be formed by uniting a force between two or more such differently operated upon portions of elemental matter."

Under this supposition the compound formed from two elements is, to use the Hibernian style of phraseology, as much an element as either of the substances from which it was formed; the only difference consisting, not in the different absolute amount of forces, but in the forces being brought to operate upon the whole combined mass of matter in a mean of the difference in which they existed in the uncombined elements.

But how is it that when this average force is attained it can never be divided to form substances of indefinite atomic proportions? How is it that the mean of force attained never equals the amount of force contained in any of the elements. or never equals the mean attained by the union of other elements?

Your correspondent asks himself the question, "How do you suppose matter to have been operated upon so as to form different kinds?" He replies by saying, "The forces which constitute the causes were created at the same time as matter was." If heat and electricity are what he calls "the forces," what an idea it is on his part to suppose that these imponderables could remain unequally distributed in matter from the time that matter was created! True it is that different substances are known to contain different quantities of latent heat, and that this latent heat is not diffused from one body to another, even when they are placed in contact; but this depends on the *different atomic weights* of the bodies, and is not observed in bodies of the same nature.

Mr. Kingzett thinks that since the forces are capable of transformation, matter must also be; and considers this idea strengthened by the fact that matter and force are inseparable.

This appears to be a confusion of ideas. That matter and force are inseparable in a physical position is no proof that they are inseparable in physical nature.

How splendidly Mr. Kingzett reveals his want of faith in the tenets of his own philosophy! For, says he, "When *iodine* is used *as in potassic iodide* it is under a peculiar force known as chemical affinity which masks the property which it possesses when free." Mr. Kingzett's philosophy requires him to believe that when two elements are united as compounds they are entirely destroyed as elements, and only form another element under a different molecular force. Yet here we have Mr. Kingzett confessing that in potassic iodide the iodine exists in its own nature; but under a peculiar force, which masks the property which it possesses when free!

That the difference between ethylic hydride and the radical methyl is merely one of molecular arrangement is obvious (apparently), but the sphere of organic chemistry is no fit place to look for the grounds of an argument; it being so infantile and so rapidly growing a science, and the causes which regulate organic combinations being buried in such profound obscurity.—I am, &c.,

John F. Sutton.

MISCELLANEOUS.

Agricultural Instruction.—At Proskau, which is situated in Upper Silesia, Prussian territory, is established an agricultural college on a large scale, in which everything relating to agriculture, horticulture, sylvestriculture, and the rearing of cattle, horses, bees, and poultry is

practically taught. In addition to several smaller lecture-rooms, there are two large amphitheatres, which will accommodate 200 students each; three separate chemical laboratories; a large distillery; beet-root sugar work; model brewery; museum for mineral and botanical collection; collection of agricultural implements; library containing 6000 volumes; four farms; 5000 hectares of forest land, and 4000 hectares (=2·47 acres to the hectare) of arable meadow land are attached to this institution, in which instruction is given by a staff of twenty-four professors. Proskau is situated very near to the Russian (Poland) frontier, and in the neighbourhood of the town several industrial establishments exist, lime-stone burning and pottery making being very largely represented. The institution alluded to is state property, and has been arranged like the institution known as Hohenheim, near Stutgardt (Wurtemburg). Proskau has 1900 inhabitants, of whom 1500 are Poles.—*Moniteur Scientifique.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, September 30, 1872.

This number contains, in addition to several original papers relating to physics, mathematics, astronomy, and natural history, the following original papers more particularly relating to chemistry:—

Stability of Dyes Fixed on Woven Fabrics in general, and more particularly on Silk.—Professor Chevreul.—This lengthy essay, elucidated by tables exhibiting results of experiments, treats on the stability of dyes imparted to silk, more particularly damascs and fabrics used in furnishing. The blue colours produced by indigo are fast and stable; Prussian blue resists moderately the action of air and light, but not of soap; scarlets and carmines produced by cochineal and lac-dye are fast; the fastest yellows on silk are produced by weld.

Researches on the Anti-Ferment Properties and Physiological Action of Silicate of Soda.—A. Rabuteau and F. Papillon.—After briefly referring to the researches of Prof. Dumas on the action of borax in fermentation (Chemical News, vol. xxvi., p. 82), the authors describe at length a series of experiments made with the view of ascertaining the effect of silicate of soda upon alcoholic fermentation, upon the fermentation of urea, upon lactic fermentation, and upon amygdalic fermentation. It appears that silicate of soda acts in a similar manner to borax, but far more energetically; not only does it prevent fermentation, but it is a strong disinfectant, and its physiological action, when injected in the blood in aqueous solution (1 to 40), is fatal to animal life, while such is not the case with borax under similar conditions.

Report of the Committee Appointed to Investigate the Alteration Produced in Bread, whereby there is Formed in it Oïdium Aurantiacum.—F. Rochard and Ch. Legros.—This memoir treats on the causes of the formation of peculiar cryptogamic plants in bread, and on the precautions to be taken to prevent this injury, which is mainly due to the use of inferior materials, a badly conducted process of preparation, and insufficient baking of the bread. The authors do not consider that the *O. aurantiacum* is injurious to animal life, because rats largely fed with it have not suffered in health; with due precautions, the use of sound materials, and proper methods of preparing and baking bread, this formation may be entirely prevented, but the addition of a larger proportion of salt will not remedy the evil.

Bulletin de l'Academie Royale des Sciences, des Lettres et de Beaux Arts de Belgique, No 8, 1872.

This number contains the following original papers relating to chemistry:—

Researches on Camphors.—E. Dubois.—This paper is the first instalment of a lengthy essay, recording the results of experiments with which the author is still engaged. The object of this investigation is the study of the chemical structure of camphors. This portion treats on the action of pentasulphide of phosphorus upon monobromated camphor, the object being to obtain bromated cymol. At the ordinary temperature pentachloride of phosphorus (first tried by the author) does not act upon monobromated camphor; at 100° there is no apparent action; at a still higher temperature, scarcely any action is noticed. 1 molecule of pentasulphide of camphor and 5 molecules of the monobromated camphor being heated together on a sand-bath, a very tumultuous reaction occurs, and partial carbonisation of the organic matter ensues. The result of this reaction is chiefly crude cymol, which, on being purified, and having been converted into cymol-sulphate of barium, yielded, by elementary analysis, the following percentical composition:—Carbon, 42·63; hydrogen, 4·62; barium, 24·33; sulphur, 11·37; oxygen, 17·04. Formula—

$$C_{20}H_{26}BaS_2O_8.$$

In addition to cymol, there are formed by this reaction small quantities of hydrocarbons of the same series, and an organic sulphydrate soluble in alkalies.

Report on the Thunderstorm during which the Turret of the Railway-Station at Mechelen (Malines) was Struck by Lightning.—A. Fassiaux.—The author, director-general of the railways (State property), post office, and telegraphs of Belgium, gives a detailed account of the curious effects of the striking by lightning of the clock-turret of this large building during a thunderstorm in July last.

Les Mondes, October 3, 1872.

International Congress on the Metric System.—The States represented at this meeting are—The United Kingdom, France, Russia, Germany, Austro-Hungary, Spain, Belgium, the Netherlands, United States, Argentine Republic, Bavaria, Chili, Columbia, Denmark, Republic of Ecuador, Greece, Haïti, Peru, Portugal, San-Salvador, Sweden and Norway, Turkey, Venezuela, Würtemberg, Italy, Nicaragua, Switzerland, Uruguay, and the Saint-Siège. It is confidently hoped that a great step in advance will be made for realising, what is highly desirable, the unification of weights and measures for different countries. The United Kingdom is represented by the Astronomer-Royal; Dr. H. W. Miller, of Cambridge; and Mr. Chisholm, the Keeper of the Standards. The Rev. Father A. Secchi, S.J., represents the Saint-Siège.

Meteorological Observatory on the Summit of the Puy de Dome.—Rev. F. Moigno.—It appears that the necessary arrangements are made for the immediate establishment of two meteorological observatories—one on the summit of this mountain, situated close to Clermont-Ferrand, in the Department of the Puy de Dome, Central France, the other in the town just alluded to—both to be in telegraphic communication; the difference in altitude between these localities is 1160 metres. Clermont is situated at about 450 metres above sea-level.

Hydro-Electric Submarine Cable.—F. Tomasi.—Illustrated by a series of woodcuts.

Spectroscope with Slide.—M. Hofmann.—The description, illustrated by woodcuts, of an improved spectroscope constructed by the author, of which it is stated that, having been lately inspected by Dr. Tyndall, Mr. Wright, Father Secchi, and others, it has been highly approved of by them.

Although not strictly belonging to chemistry, we call attention to the contents of the following paper:—

Geographical Works.—A. Marie.—The author, Professor at the Normal School of Carlsbourg (Belgium), has invented a greatly improved method of making maps and charts, termed hypsometrical, whereby the countries which are exhibited are shown as they are in their natural state, so that a sound idea of the real configuration of the land, rivers, lakes, mountains, &c., is given at a glance.

Bulletin de la Société Chimique de Paris, August 15, 1872.

This number contains the following original papers and memoirs:—

Essay on the Phosphoplatinic Compounds.—P. Schützenberger and E. Fontaine.—The third instalment of this exhaustive monograph; it contains the following sections:—Action of zinc on the ethyl-phosphoplatinous (*platineux*) ether; amyl-phosphoplatinous ether; action of the phosphoplatinous chloride upon glycerine, allylic alcohol, benzylic alcohol, ammonia, and compound ammonias; phosphoplatinic ethers; methyl-phosphoplatinic ether; ethyl-phosphoplatinic ether. This essay, elucidated by a large number of complex formulæ, is to be continued.

Contribution to the History of Mesoxalic Acid.—J. Ossikovszky.—From chloroxalic ether—

$$C_2O_2{<}^{Cl}_{OC_2H_5}$$

(prepared by the action of oxychloride of phosphorus upon ethyl-oxalate of potassium), by the action of cyanide of potassium, and next saponification of the cyanoxalate of ethyl thus formed, no mesoxalic acid is obtained, the result of the reactions being the formation of oxalic acid.

Acetyloxamate of Ethyl.—J. Ossikovszky and G. Barbaglia.—The authors describe at length the reaction which takes place when 2 molecules of fused acetamide and 1 molecule of chloroxalate of ethyl are mixed; the final result of this reaction, assisted by heat and purification of the new product, is the formation of a liquid which exhibits the following characters:—It is not precipitated by chloride of calcium; gives off ammonia very abundantly when boiled with concentrated caustic soda solution; nitrate produces a feeble opalescence not dissolved by nitric acid; treated with boiling water,

it yields a large quantity of acetic ether, which volatilises; while, on evaporation, the solution yields acid oxalate of ammonium—

$$\underbrace{CO-HN-CO-CH_3 \\ | \\ COOC_2H_5}_{\text{Acetyloxamate of ethyl.}} + 2H_2O = \underbrace{CH_3 \\ | \\ COOC_2H_5}_{\text{Acetate of ethyl.}} + \underbrace{COOH \\ | \\ COONH_4}_{\text{Acid oxalate of ammonia.}}$$

By distillation, the substance (acetylomate of ethyl) is decomposed, depositing carbonaceous matter, while acetic ether and acetamide are produced in small quantity; on being kept for a long time, the liquid deposits crystals, which, on analysis, yield results leading to the formula—

$$CO-HN-CO-CH_3 \\ | \\ COOC_2H_5$$

Researches on Guanidine.—J. Ossikovszky.—The author describes at length a method of preparing guanidine as directed by Bannow, and consisting in heating iodide of cyanogen with three times its weight of ammoniacal alcohol (at 10 per cent NH_3) in sealed tubes, followed by a lengthy and rather tedious process of purification; it appears that there is simultaneously formed a fatty acid (probably propionic acid), which, however, was not obtained by the author in free state, Guanidine is, while taking up the elements of water under the influence of hydrate of baryta, readily converted into ammonia and urea, or into the products of decomposition of the latter, viz., carbonic acid and ammonia.

Action of Salts of Lime upon a Decoction of Cochineal.—E. Guignet.—A black-coloured carminate of lime is obtained by treating carminic acid or a decoction of cochineal with a solution of bicarbonate of lime, whereby an abundant precipitate is formed, which is insoluble in water and alcohol, and yields with lime-water a violet-coloured basic carminate of lime; while, when the black carminate is heated along with a solution of neutral acetate of lead, there is formed a bluish-violet coloured carminate of lead. It is necessary to employ in these reactions lime salts quite free from iron, because the decoction of cochineal is precipitated by the salts of that metal, yielding with it black-coloured compounds. It appears that the action of salts of lime upon cochineal is so characteristic that it may be used as a test for lime; the author states that several commercially-sold products, such as glue and starch, for instance, which have been prepared with lime salts containing water, are coloured black by a decoction of cochineal.

Pyrogenic Oils of Pechelbronn (Alsace).—J. A. le Bel.—The exhaustive and detailed description of various products (hydrocarbons) obtained by fractional distillation from the petroleum oil prepared from the bituminous shale met with at the locality alluded to; the author also gives a description of a distillatory apparatus invented by him, and contrived for the purpose of rendering fractional distillation a more readily managed and continuous operation.

Note on some Unfinished Experiments Relating to the Reciprocal Transformation of Dextro- and Levo-Tartaric Acid.—Lecoq de Boisbaudran.

Oxidation of Sugar by means of Permanganate of Potassa.—J. Maumené.—By this oxidation there are formed two acids—Hexépic, $C_{12}H_{12}O_{16}=C_{12}H_{11}O_{15}HO$; and triépic—$C_6H_6O_{10}=C_6H_5O_9HO$.

The author points out in the following manner the relation existing between hexépic acid and acids already long known:—

Hexépic acid,	$C_{12}H_{12}O_{16}$
Saccharic acid,	$C_{12}H_{10}O_{16}$
Malic acid,	$C_{12}H_9O_{15}(C_6H_6O_{10}\times 1\frac{1}{2})$
Tartaric acid,	$C_{12}H_9O_{13}(C_6H_6O_{12}\times 1\frac{1}{2})$
Carbomethylic acid,	$C_{12}H_{12}O_{13}(C_4H_4O_6\times 3)$

Le Moniteur Scientifique Quesneville, No. 370, October, 1872.

This number only contains the two following original communications:—

Estimation of Lithia in Mineral Waters.—F. Wurtz.—As it is difficult to entirely separate lithia present in mineral waters from lime, the following method was applied by the author, while analysing the mineral water of the Madeleine spring of Vals:—15 litres of the water are first evaporated to one-tenth of the original bulk, and the liquid is next filtered, for the purpose of eliminating carbonate and sulphate of lime and earthy matters deposited during the evaporation. To the filtrate is added perfectly pure carbonate of soda in slight excess, in order to precipitate earthy matters kept in solution; after this, the liquid is evaporated to dryness, the residue is treated with boiling distilled water, and the liquid is filtered while hot into a small porcelain or platinum crucible placed on a water-bath. To the hot filtrate, phosphate of soda is added, whereby the carbonate of lithia, hitherto kept in solution, is precipitated as phosphate of lithia, which, with the liquid wherein it is suspended, is evaporated to dryness; the residue is next treated with cold water, and the insoluble salt is thrown on a filter, and, after drying, weighed. In order to test whether there is any phosphate of lime mixed with the phosphate of lithia, the latter is dissolved in perfectly pure and dilute sulphuric acid, care being taken to use no more acid than is just required, according to the weight of the phosphate of lithia obtained. This solution is next treated with neutral acetate of lead, forming insoluble sulphate and phosphate of lead, while acetate of lithia and acetate of lime (supposing the lithia salt to have been still contaminated with lime) are kept in solution; the excess of lead is removed by sulphuretted hydrogen, and the liquid again filtered; some pure and dilute sulphuric acid is again added to the filtrate, and the liquid again evaporated to dryness upon a water-bath. The sulphate of lithia is next treated with boiling alcohol, in which any sulphate of lime which happens to be present is insoluble; the alcoholic solution, previously filtered if the sulphate of lime was present, is lastly evaporated to dryness, and the sulphate of lithia weighed.

Preparation of Alcohol from Sawdust.—M. Zetterlund.—Into an ordinary steam-boiler, heated by means of steam, were introduced 9 cwts. of very wet sawdust, 10·7 cwts. of hydrochloric acid (sp. gr. = 1·18), and 30 cwts. of water; after eleven hours' boiling, there was formed 19·67 per cent of grape sugar. The acid was next saturated with chalk, so as to leave in the liquid only a small quantity ($\frac{1}{2}$ degree by Ludersdorf's acid areometer); when the saccharine liquid was cooled down to 30°, yeast was added, and the fermentation finished in twenty-four hours. By distillation, there were obtained 26·5 litres of alcohol of 50 per cent at 15°, quite free from any smell of turpentine, and of excellent taste. It appears that the preparation of alcohol from sawdust may be successfully carried on industrially when it is precisely ascertained what degree of dilution of acid is required, and how long the liquid has to be boiled. When all the cellulose present in sawdust might be converted into sugar, 50 kilos. of the former substance would yield, after fermentation, 12 litres of alcohol at 50 per cent.

Bibliography.—Under this heading we quote the title of a work which is highly spoken of—"Précis de Chimie Légale; Guide pour la Recherche des Poisons, l'Examen des Armes à Feu, l'Analyse des Cendres, l'Alteration des Ecritures, des Monnaies, des Alliages, des Denrées et la Détermination des Tâches dans les Expertises Chimico-Légales; à l'Usage des Médecins, Pharmaciens, Chimistes, Experts, Avocats, &c.," par A. Naquet, Professeur Agrégé de la Faculté de Médecine de Paris; avec 18 figures dans le texte; 1 vol. in 18. Paris, chez Savy, Libraire, Rue Hautefeuille, No. 24; prix, 3 francs.

Sitzungsberichte der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften zu München, No. 1, 1872.

In addition to several original memoirs relating to natural history, anatomy, geology, and physics, this number contains the following original papers and memoirs relating to chemistry:—

Products of the Decomposition of the Quecksilberfahlerz of Mosschellandsberg in the Pfalz.—F. Sandberger.—The mercury ore which is met with in Rhenish Bavaria has an iron-grey colour, a metallic lustre, a sp. gr. of 5·095, and consists, in 100 parts, of—Sulphur, 21·90; arsenic, 0·31; antimony, 23·45; bismuth, 1·57; copper, 32·19; mercury, 17·32; iron, 1·41; cobalt, 0·23; zinc, 0·10; gangue, 1·39. There is met with at the same locality another quecksilberfahlerz (the German name is retained in Dana's "System of Mineralogy"), the sp. gr. of which varies from 5·509 to 5·511, while, in addition to its containing 24·1 per cent of mercury, it also contains 5·62 per cent of silver. The author treats, further, on the spontaneous decomposition of the first-mentioned ore, and states that, according to his investigation of the weathered mineral, no loss of mercury ensues.

Influence of Absolute Alcohol upon some Chemical Reactions.—Dr. Vogel.—The author records in this paper a series of reactions which are modified, or even entirely suspended, by strong alcohol, in consequence of the insolubility in that fluid of many substances which are soluble in weaker alcohol and in water. Two reactions are more particularly alluded to, viz., that of starched test-paper and tincture of iodine, and the behaviour of metallic potassium with strong (absolute) alcohol. When potassium is put into a basin containing alcohol stronger than 0·823 sp. gr., no ignition of the metal takes place, which is, however, oxidised, and rotates as it does when thrown upon water; when thrown upon alcohol of 0·830 sp. gr., ignition takes place.

Action of Active Oxygen upon Pyrogallic Acid.—H. Struve.—This lengthy essay treats on the action of peroxides and other oxidising substances upon pyrogallic acid alone or in the presence of gum, blood, saliva, malt extract, &c. It appears that pyrogallic acid yields several coloured products of oxidation, among which purpurogallin is one of the most prominent.

PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2450. F. Lipscombe, Strand, Middlesex, "Improvements in the treatment of noxious vapours, and in apparatus or appliances in connection therewith."—Petition recorded August 16, 1872.

2518. W. Lockhead, Glasgow, N.B., "Improvements in treating asbestos or amianthus and applying the same to various useful purposes."—Petition recorded August 24, 1872.

2576. G. Spencer, Cannon Street, London, "Improvements in the purification of coal gas used for illuminating purposes and for mechanical purposes, and in apparatus therefor."—A communication from E. White, New York, U.S.A.—Petition recorded August 30 1872.

2614. B. W. Gerland, Macclesfield, Cheshire, "Improvements in the manufacture of phosphoric acid, phosphatic manures, akaline, and other phosphates."—A communication from H. and E. Albert, Biebrich, Germany.—Petition recorded September 3, 1872.

2649. W. Meister, Dr. E. Lucius, and Dr. A. Brüning, Hochst, near Frankfort-on-the-Maine, Germany, "Improvements in the manufacture of colouring matter suitable for dyeing and printing,"

2650. J. C. Ramsden, Lightcliffe, Halifax, Yorks, "A new or improved means or method of and apparatus for securing the combustion of fuel, and for the utilisation of the gases arising therefrom."

2651. S. Carter, Highgate Road, Middlesex, "Improvements in fuel."—Petitions recorded September 6, 1872.

2665. J. Berry, Dublin. "Improvements in the manufacture of peat fuel."—Petition recorded September 9, 1872.

2687. B. B. Standen, Blackheath, Kent, "Improvements in collecting and treating human excrement, both solid and liquid, and in the treatment of other animal urine, also in the means or apparatus employed therein."

2690. T. Jackson and T. Southan, Coatbridge, "The application of titanic iron ore in making and repairing bottoms of heating and reheating furnaces in place of sand, in order to utilise the cinder from such furnaces for fettling puddling furnaces."

2692. F. A. Gatty, Accrington, Lancashire, "Improvements in producing certain colours on cotton fabrics and yarns."

2693. S. J. Mackie, Delahay Street, Westminster, "Improvements in the manufacture and storing of gun-cotton."—Petitions recorded September 11, 1872.

2704. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the manufacture of sulphate of soda."—Petition recorded September 12, 1872.

2717. W. S. Dixon, Grosvenor Place, Middlesex, "Improvements in the manufacture of plute iron or refined metal."

2719. W. R. Lake, Southampton Buildings, London, "An improved process and compound for tempering and refining steel."—A communication from W. N. Severance, South Bend, Indiana, U.S.A.—Petitions recorded September 13, 1872.

2745. E. T. Hughes, Chancery Lane, London, "Improvements in the manufacture of the salts, carbonates, and hydrates of baryta and strontia, and also for improved modes of making baryta and strontia caustic."—A communication from L. G. G. Daudenart and E. Verbert, Schaerbeck, Brussels."—Petition recorded September 16, 1872.

2770. A. E. Webb, Stepney, Middlesex, "A process of treating oils, spirits, and fatty matters, whereby they are rendered disinfecting and deodorising during the combustion thereof, and by which the said oils are purified."—Petition recorded September 18, 1872.

2772. J. W. Gray, Billiter Street, London, "An improved explosive compound."—A communication from J. Hall, Place d'Armes, Pas de Calais, France.

2779. A. C. Fraser, Finsbury Park, London, "Improvements applicable to retorts for the manufacture of gas."

2782. G. H. Smith, New York, U.S.A., "An improved method of treating brick, porous stone, and other like materials to increase their hardness, durability, and impermeability."—Petitions recorded September 19, 1872.

2790. R. Stone, Liverpool, "An improved artificial fuel."—Petition recorded September 20, 1872.

2801. J. McDougall, Manchester, "Improvements in the manufacture of manures."—Petition recorded September 21, 1872.

2805. W. Rath, Plettenberg, Westphalia, "Improvements in annealing and removing of oxide or scale from iron and steel wire, and other articles of iron and steel."—Petition recorded September 23, 1872.

2830. G. Smith, Chelsea, Middlesex, "Improvements in enamelling stoneware, Bristol ware, and earthenware of the like nature."—Petition recorded September 25, 1872.

INVENTIONS PROTECTED BY THE DEPOSIT OF COMPLETE SPECIFICATIONS.

2783. J. H. Valleton and J. E. Planque, Great Tower Street, London, "Improvements in the manufacture of bread, biscuits, and pastry."—Petition recorded September 19, 1872.

2786. P. P. F. Micheá, Jubbulpore, East India, "New substances for dyeing, printing, and tanning, and the process employed for treating one of such substances."

2787. P. P. F. Micheá, Jubbulpore, East India, "New substances for dyeing, printing, and tanning, also applicable for the manufacture of paper and threads or yarns."—Petitions recorded September 20, 1872.

2827. C. J. A. Dick, Pittsburgh, Penn., U.S.A., and G. A. Dick, Cannon Street, London, "Improvements in the manufacture of wires applicable to telegraphic purposes."—Petition recorded September 25, 1872.

NOTICES TO PROCEED.

1421. J. Robey, Manchester, "A new or improved filtering medium, suitable also as a disinfectant and deodoriser."—Petition recorded May 11, 1872.

1466. E. G. Brewer, Chancery Lane, "Improvements in the manufacture of steel, steely iron, and homogeneous metal, and in apparatus therefor."—A communication from F. G. Bazault and J. J. Roche, Paris.

1469. G. Bedson, Manchester, "Improvements in puddling furnaces."—Petitions recorded May 14, 1872.

1521. C. Herveux, Islington, Middlesex, "Improvements in tanning and in apparatus therefor."—Petition recorded May 18, 1872.

1540. H. Kenyon, H. Kenyon, and J. Swindells, Warrington, Lancashire, "Improvements in the manufacture of chlorine and sulphuric acid."—Petition recorded May 21, 1872.

1554. G. Haycraft, Faversham, Kent, "Improvements in the manufacture of pebble gunpowder, and in machinery for the same."—Petition recorded May 22, 1872.

1574. W. R. Lake, Southampton Buildings, London, "An improved process of manufacturing sheet-iron."—A communication from W. Rogers, Apollo, and T. J. Burchfield, Allegheny, Penn., U.S.A.

1583. J. C. Johnson, Newcastle-upon-Tyne, "Improvements in the manufacture of Portland and other cements."—Petitions recorded May 23, 1872.

2332. J. Deere, Briton Ferry, Glamorganshire, "Improvements in the manufacture of artificial fuel."—Petition recorded August 5, 1872.

2341. C. Morfit, Baltimore, Ma., U.S.A., "Improvements in the manufacture of pure phosphates of lime."—Petition recorded August 6, 1872.

2344. C. Morfit, Baltimore, Ma., U.S.A., "Improvements in the chemical treatment of mineral and other crude phosphates of lime."—Petition recorded August 7, 1872.

2357. C. Morfit, Baltimore, Ma., U.S.A., "An artificial substitute for 'redonda guano,' 'alta vela' guano, and other natural phosphates of alumina, to be used in the defecation of sewage, in the manufacture of sugar from cane and beet-root juices, and in the preparation of certain chemical products, such as pure alumina and the alkaline and earthy phosphates and aluminates."—Petition recorded August 8, 1872.

2506. E. A. Cook, Viewville House, Midlothian, N.B., "Improvements in treating animal charcoal."—Petition recorded August 23, 1872.

2644. J. Harvey, Vere, Jamaica, "Improvements in the manufacture of sugar and in apparatus therefor."—Petition recorded September 5, 1872.

2783. J. H. Valleton and J. E. Planque, Great Tower Street, London' "Improvements in the manufacture of bread, biscuits, and pastry."—Petition recorded September 19, 1872.

PATENTS SEALED.

899. W. Garton, Southampton, "Improvements in brewing."—Dated March 25, 1872.

979. W. R. Lake, Southampton Buildings, London, "An improved compound for cleansing carpets and other woven fabrics."—A communication from L. Stern, Boston, Mass., U.S.A.—Dated April 3, 1872.

989. J. C. Sellars, Birkenhead, Cheshire, "Improvements in obtaining hydrocarbon liquids, gas for illuminating and heating purposes, and coke."—Dated April 4, 1872.

1044. W. R. Lake, Southampton Buildings, London, "Improvements in the manufacture of pulp from vegetable fibres for making paper and other materials."—A communication from G. Swift, San Francisco, Ca., U.S.A.—Dated April 8, 1872.

1088. W. R. Lake, Southampton Buildings, London, "An improved process of converting cast-iron, and articles made thereof, into steel."—A communication from H. H. Date, and F. H. Date, St. Catherine's, Ontario, Canada.

1089. J. Anderson, Newbuildings, Londonderry, Ireland, "Improvements in refining iron, in obtaining malleable iron and steel, and in apparatus therefor."—Dated April 12, 1872.

1103. R. Tiernan, Liverpool, "An improved manner of treating tobacco."—Dated April 13, 1872.

1229. C. G. Kleberg, Cannon Street, London, "Improvements in the manufacture of sugar, and in the apparatus employed therein."—A communication from N. Tsherikovsky, Smela, Russia.—Dated April 24, 1872.

1240. H. Gahn, Upsala, Sweden, "Improvements in cosmetics."—Dated April 25, 1872.

1265. E. A. Cowper, Great George Street, Westminster, "Improvements in the process of converting wood and other fibrous materials into pulp, and in apparatus therefor."—Dated April 27, 1872.

1997. W. E. Newton, Chancery Lane, "An improved process for surface-hardening steel."—A communication from G. Ames, Rochester, New York, U.S.A.—Dated July 2, 1872.

2279. J. Brown, Edinburgh, N.B., "Improvements in the treatment of sewage, and in the manufacturing of manures."—Dated July 30, 1872.

FOREIGN PATENTS.

BELGIUM.

31012. A. B. Boyer, "A disinfecting process."—Dated August 8, 1872.

31021. T. L. Dubiez-Lecluselle, "Manufacturing and employing a kind of manure."

31022. C. V. Viard, "So-called 'Condensed Vichy Salt Milk.'"—Dated August 10, 1872.

31042. G. Messerschmidt, "Manufacturing vinegar."—Dated August 14, 1872.

31049. J. J. Bodmer, "Improvements in the manufacture of iron and steel."—Dated August 16, 1872.

31060. J. Anderson, "Improvements in the reduction of oxides."—Dated August 19, 1872.

31076. B. Russ, "Improvements in the manufacture of gas, and treatment of its residues."—Dated August 21, 1872.

31078. P. Schmitz, "A liqueur called 'Sanitary Bitters.'"—Dated June 12, 1872.

NOTES AND QUERIES.

Fusion-Point of Cæsium.—Could your readers favour me with the fusion-point and weight of the metal cæsium?—THOS. W. HALL, M.D., L.R.C.S.E.

Constituent Fatty Acids of Palm-Nut Oil.—I shall be very glad if your readers can inform me what are the constituent fatty acids of palm-nut oil, or tell me where I can learn. I have sought the information in back numbers of the CHEMICAL NEWS, and in Miller's and other text-books; but it does not seem to have been much studied. If you will kindly assist me in this I shall be greatly obliged. —F. H. T. A.

THE CHEMICAL NEWS.

Vol. XXVI. No. 673.

NEW PROCESS FOR THE MANUFACTURE OF IODIDE OF POTASSIUM FROM THE MOTHER-LIQUORS OF KELP.*

By E. SONSTADT.

This process consists in converting the alkaline iodides, contained in the mother-liquors from kelp, into iodates; precipitating the iodic acid by a soluble barium salt; heating the precipitate with solution of sulphate of potassium, which gives iodate of potassium in solution; drying up and melting the iodate of potassium solution, and crystallising the solution of the melted iodide of potassium thus obtained.

The conversion of iodides into iodates in the mother-liquors is effected by one of the following processes. But it is advisable, first, to partially or completely precipitate the sulphuric acid from the mother-liquor by solution of chloride of barium or other suitable barium salt, as thus silicic acid, if present, and other impurities are separated, and the precipitate afterwards obtained of iodate of barium is more manageable. The mother-liquor is then, after separation of the precipitate, melted, to destroy organic matter. The melted mass is dissolved in water, and the solution, after separation from the residue, is, if intended for treatment by any of the processes except the last undermentioned, rendered alkaline by addition of a caustic or carbonated alkali, to such extent that the liquid may contain, for each atom of an iodide in it, five atoms of a caustic alkali, or ten atoms of a carbonated alkali. The liquid thus prepared may then be treated by any of the following processes for conversion of the iodide in it into iodate.

(1.) Chlorine is passed through the liquid until the whole of the iodide is transformed into iodate, but no longer.

(2). Solution of a permanganate is added until a slight permanent colouration of permanganate remains. The liquid is then separated from the manganese precipitate, which latter may be furnaced with soda, or with soda and nitre, to re-form permanganate for another operation.

(3). By passing an electric current through the dilute solution in the way usual in electrolysis. This process would be convenient and economical where the electricity can be obtained from electro-magnetic machines worked by water-power.

(4). In this process, the purified mother-liquor is dried up with addition of an atom of an alkaline chlorate for each atom of an iodate present. The mixture is then cautiously heated below redness until the iodide is converted into iodate.

After the iodic acid is separated from the mother-liquors, the bromide remaining in solution may be converted into bromate by either the processes (1) or (4), and bromide of potassium, obtained by the same methods as used for obtaining iodide of potassium. Processes (2) and (3) are not applicable to the formation of bromate.

* Patent No. 1054, April 10, 1872.

ON THE OCCURRENCE AND DETECTION OF VANADIUM AND TITANIUM IN TRAP-ROCKS.

By RICHARD APJOHN.

While working in the Bonn Laboratorium, under the late Professor Engelbach, he mentioned to me that he had found vanadium and titanium in the trap-rock which occurs in the adjacent Rhine district. Since then, on considering the subject, it seemed to me that it would be a matter of interest to extend the investigation further, and to operate on a number of different specimens of trap-rock. I accordingly undertook, with this object, a series of experiments, which I shall now briefly describe. Three different basalts were made the subject of examination, viz., one from a trap-dyke at Dunamoe, County Wicklow, one from the Giant's Causeway, and one from Vicentine, Italy.

Process for Detection of Vanadium.

Eight grammes of the finely-powdered mineral was fluxed with four times its weight of carbonate of sodium. The fused mass was then allowed to cool, and a small quantity of nitre was added. It was now heated over the Bunsen's lamp, taking care that the crucible did not attain more than a dull red heat. The mass was lixiviated with water, and the aqueous solution was boiled with carbonate of ammonium, and filtered to remove silicic acid. The filtrate was evaporated with hydrochloric acid, and sulphide of hydrogen was passed in to precipitate any metals of the lead group which might be present. The filtered solution was then treated with an equal volume of very concentrated solution of ammonia, and sulphide of hydrogen was passed in till all the free ammonia was saturated.

In the case of each specimen the solution assumed a beautiful intense cherry-red colour, a sure indication of the presence of vanadium. This coloured liquid was filtered off and saturated with hydrochloric acid; the precipitate, containing sulphur and sulphide of vanadium, was dried and ignited, and the residue was melted with a pinch of nitre. From the vanadate of potassium thus formed the characteristic blowpipe reactions were obtained.

Detection and Estimation of Titanium.

Twelve grammes of the finely-powdered rock were fluxed with six times their weight of acid sulphate of potassium, and the heat was continued until the greater part of the free sulphuric acid was driven off. The cooled mass was reduced to a fine powder, exhausted with cold water, and the aqueous solution (it should be largely diluted) was boiled with acid sulphite of sodium. As soon as the precipitation was complete, the contents of the flask were allowed to cool, and a little sulphurous acid was added to re-dissolve any iron or aluminium which might have been precipitated. This precipitate of titanic acid was converted into the titano-fluoride of potassium in the usual manner, and the salt thus obtained was collected on a weighed filter, washed with a few drops of cold water, dried, and weighed; and from this weight the amount of titanic acid was deduced. With a view to testing the accuracy of this result, the titano-fluoride was dissolved in hot water, and the titanic acid was precipitated by ammonia, ignited, and weighed.

The results obtained in these experiments are given in the following table:—

	K_2TiF_6.	TiO_2 calculated from K_2TiF_6.	TiO_2 precipitated by NH_3.	Per cent of TiO_2 in Trap-rock.
12 grms. of Wicklow trap gave	0·660	0·222	0·190	1·58
12 grms. of Giant's Causeway basalt gave	0·240	0·081	0·084	0·70
12 grms. of Vincentine (Italy) basalt gave	0·325	0·110	0·110	0·91

The titanic acid beads, formed with salt of phosphorus in the reducing flame, exhibited that pure amethyst shade which showed that the iron had been completely separated.

It is interesting to observe how closely the titanic acid calculated from the titano-fluoride agrees with that which was found by precipitation with ammonia. The numbers yielded by the two methods are so nearly the same, that small quantities of titanic acid would, I am sure, be best

estimated by weighing it in the form of titano-fluoride. Such a course would be recommended by the fact of the atomic weight of the titano-fluoride being nearly three times that of titanic acid. The modern analyses of trap-rocks are few in number, and but in one (see Watts's "Dictionary," vol. iv., p. 251) is the presence of titanic acid noticed. It appears to me, therefore, a matter of some importance to put upon record the fact that, in the specimens of this rock which I have examined, both of these constituents occur, and in quantities which admit of estimation. The data are probably insufficient to justify the conclusion that these rare elements exist in all trappean rocks; but the results of the experiments which I have made would seem to invest such a conclusion with some degree of probability.

ON THE

ABSORPTION OF ATMOSPHERIC NITROGEN BY VEGETATION.*

By M. P.-P. DEHERAIN.

NUMEROUS analyses of arable earths now in the possession of agricultural science, have established the fact that there exists in soil a considerable quantity of combined nitrogen, whose origin cannot be attributed to old dressings, inasmuch as M. Boussingault has observed that the amount of nitrogen contained in the vegetation collected during the distribution growth of crops upon a given surface exceeded the quantity contained in the manure which that surface had received. The excess is often considerable, and must be explained either by admitting that plants draw nitrogen directly from the air and fix it in their tissues, or, that in consequence of some reaction as yet but little known, arable earth becomes gradually charged with atmospheric nitrogen, which is then transmitted to the vegetation.

The numerous experiments attempted in France by M. Boussingault, and in England by Messrs. Lawes, Gilbert, and Pugh, in order to ascertain whether plants absorb nitrogen directly from the air, have failed. The production of ammonia or nitric acid by meteoric phenomena, rain, snow, or dew, is scarcely sufficient to cover the loss occasioned by the evaporation of ammonia in the air by the draining of superficial and sub-soil waters, which easily carry away nitrates, and, lastly, by the emission of free nitrogen which is produced during the decomposition of organic matter used as manure. It is therefore evident, *a priori*, that some powerful cause must determine in the soil that fraction of the nitrogen revealed there by analysis. After reflecting upon the various circumstances under which the union of the two elements of the air occurs, it is found to habitually accompany the oxidation of combustible matter; and it seemed to me that oxidation of the organic matter arising from the remains of former vegetation, or from manure, might perhaps produce the combination of atmospheric nitrogen with oxygen.

To render this certain, I resolved to undertake two series of experiments. By the first I have ascertained the absorption of gaseous nitrogen during the oxidation of organic matter. In the second, which will be the subject of a later communication, I examined the nitrogen in combination by endeavouring to point out those reactions which produce the black matter of arable earth. After several attempts, I succeeded in obtaining a regular absorption of nitrogen by the following means. Into a matrass of green glass capable of containing 200 c.c. was introduced a mixture of equal volumes of air and oxygen, whose exact composition had been ascertained, and then a liquid consisting of 15 grms. of glucose dissolved in 15 c.c. of water, and 15 c.c. of common ammonia. This is closed before the blowpipe, and, if the manipulation is rapid, only a very insignificant portion of air can enter the matrass. Even should a larger quantity obtain entrance, the experiment will not be spoiled. The proportion of nitrogen in the matrass will become rather larger than is indicated by the analysis, only a small quantity of the nitrogen absorbed passing unperceived. Heat is applied for 100 hours by the water-bath, and when completely cooled the height of the liquid is marked upon the neck of the reversed matrass, and the end is broken under water. With the preceding proportions the absorption is considerable, nothing but nitrogen remaining. All oxygen and carbonic acid will have disappeared; the gas is collected in a graduated éprouvette, the entire absence of oxygen or carbonic acid is ascertained by potash and pyrogallic acid, and the remaining quantity of nitrogen is read off, the quantity being considerably less than what was introduced. Here are particulars of the two experiments. Of 100 parts of gas introduced, 58·40 consisted of oxygen; 41·60 nitrogen; the liquid glucose and ammonia occupied 30 c.c.; and the gas contained in the matrass 184 c.c. Before the experiment there were 76·5 c.c., of nitrogen in the mixture, when, after heating the matrass, the end was broken under water, only 70 c.c. of gas were found, containing neither oxygen nor carbonic acid. 6·5 c.c. of nitrogen were therefore absorbed, or 8·6 per 100.

In one of the experiments made with the nitrated glucose of M. P. Thenard, and with ammonia, with gas containing 52 of nitrogen to 48 of oxygen, an absorption was ascertained of 11·3 c.c. against 53 introduced, that is to say 21·5 per 100.

Six experiments were made with humic acid mixed with potash, acting upon atmospheric air; and of 100 volumes of nitrogen introduced, an average of 7 volumes was absorbed. Two experiments were made with decayed wood mixed with potash; the introduced gas was rich in oxygen, and 3·6 were absorbed per 100 volumes. Upon substituting ammonia for the potash, no absorption of nitrogen was perceived; on the contrary, at the end of the experiment more nitrogen was found than at the commencement. In twenty of these experiments made with glucose and ammonia acting upon equal volumes of air and oxygen, an average absorption was established of 5·9 c.c. of nitrogen to 100 introduced. Lastly, in four experiments in which a mixture of M. P. Thenard's nitrated glucose with ammonia was employed, an average absorption of 15·4 to 100 of introduced nitrogen was observed.

Thus in the presence of slow combustion of organic matter, atmospheric nitrogen enters into combination, probably to form nitric acid, which, from contact with excess of carbonaceous matter is reduced, and yields its nitrogen to the organic matter. This last reaction has been established by M. P. Thenard, and having verified it, we may, by depending upon it, endeavour to imagine what is the origin of the excess of nitrogen found in plants, and in the soil over the quantity furnished by manures. The conditions under which atmospheric nitrogen is brought into combination require that some organic matter should be consumed in the air; every plant which leaves remains upon the soil which bears it is therefore the means of more or less fixation of nitrogen. This reaction continues during many years, and ends by accumulating upon soil abandoned to spontaneous vegetation, such as waste land, a quantity of nitrogen sufficient to enable a cultivator, after clearing, to obtain several crops of cereals without the introduction of nitrated manure. It is thus that prairies and forests suffice for the regular supply of hay and wood without man's interfering to compensate for the periodical losses to which they have been subject from time immemorial.

The productive powers of the soil of forests and prairies are, however, not to be compared to those of arable land. The vegetable remains left upon the former are not in so favourable a state for combustion as those which form the dressing received by the latter, for we have already seen that the nitrated glucose which occurs during the manu-

* Extract by the Author.

facture of farmyard manure is the most favourable of all mixtures employed for the fixation of atmospheric nitrogen. The action of manure upon vegetation is not due only to the six-thousandths of nitrogen which it contains, but also to the decomposing carbonaceous matter which constitutes the entire mass; when buried in the earth, this matter is preserved there some time if the cultivator does not endeavour to finish its oxidation. To this end he tears the earth with his ploughshare, he aërates it, he is unsparing of his means; under the influence of the air the organic matter burns, yielding those considerable quantities of carbonic acid which the analyses of MM. Boussingault and Lewy have discovered in the air entangledin the earth. This combustion determines the union of the two elements of the air, and there is added to the nitrogen which the dressing naturally contains, that which, drawn from the atmosphere, is thence conducted through the series of metamorphoses, which transmit it from the soil to the plant and from the plant to the animal.

What are the conditions of composition, aëration, and of moisture most favourable to the fixation of atmospheric nitrogen in arable soil? This is an important question, since experiment shows that the circumstances under which the combination of gaseous nitrogen occurs are very clearly defined; it does not take place if oxidation is either too rapid or too slow, and it is probable that nitrogen does not become fixed with the same facility in all kinds of earth. Further study of the subject may lead to development of the conditions most favourable to the accomplishment of this remarkable phenomenon, and thus to ascertaining one of the dominant causes of fertility.—*Comptes Rendus.*

WATER ANALYSIS IN INDIA.

By EDWARD NICHOLSON,
Assistant Surgeon, R.A.; Analyst of Waters, Mysore, Northern and Ceded Districts.

In your columns of the 7th of June (Chemical News, vol. xxv., p. 273) appears a letter from Dr. Macnamara, Chemical Examiner to Government at Calcutta, deprecating my condemnation of the Bengal water analyses made under his superintendence. He states that fifteen years of experience had enabled him to know the peculiarities of Indian waters, that he had fully recognised them, and had caused them to be recognised by his analysts, especially as regards the occurrence of nitrates in unpolluted waters. Now I have looked carefully through seven half-yearly Reports of these analyses, and the remarks made thereon by Dr. Macnamara. I find in them not a trace of any such recognition; on the contrary, I find hundreds of waters condemned because they contain some nitric acid or a rather large amount of chlorides; I even find recommendations that large cantonments shall be abandoned, solely because the amount of these constituents does not please the analysts. I can adduce plenty of facts in support of my assertions, but will content myself for the present with quoting two of Dr. Macnamara's own analyses *in extenso*, so as to show both the chemistry of a scheme elaborated after fifteen years' experience, and the kind of evidence on which waters are condemned.

I may premise by stating that the form of analysis here laid down was obligatory. The "soluble" salts of a water might contain earthy nitrates, sulphates, or chlorides, in addition to alkaline salts, yet they must be given as chloride of sodium, sulphate of soda, carbonate of soda; no deviations were allowed; and an analyst who gave the actual constituents of the water was checked, and ordered to repeat the analysis according to the form ordered.

The two analyses I am about to quote are to be found in the fourth volume of Reports; they will be the best commentary on his statement that "no one would think of condemning a water simply because it contained a large amount of nitrates or of chlorides."

Wells in Fort William, Calcutta.

	Well near Chowringhee Gate.	Well near Treasury Gate.
Physical properties	good	good
Total hardness (degrees)	6·1	9·8
Permanent ditto (,,)	4·6	1·8
Removable ditto (,,)	1·5	8·
Grs. of oxygen required for organic matter in 1000 grs. water	·00012	·000125
Ammonia	,,	present
Nitric acid (grs. per gallon)	2	1
Total solids (,, ,,)	67·6	38
Volatile matters (,, ,,)	1·6	1·5
Mineral matters (,, ,,)	66	36·5
Earthy salts, silica, &c., insoluble (,, ,,)	29	14·5
Lime, calculated as carbonate (,, ,,)	18	10
Silica	traces	traces
Soluble salts	37	22
Chloride of sodium	20·5	12·5
Sulphate of soda	5·5	3·6
Carbonate of soda	not determined.	not determined.

Abstract of Remarks.—These wells are both properly constructed with efficient parapet platform and drain—the first well 41 feet deep, with 6 feet water; the second 29 feet, with 4 feet water. The sepoys who use them consider both waters of good quality. The first well has a bazar 48 feet off; sepoys' quarters are close at hand, and the sepoys bathe and wash their cooking utensils in the vicinity of the well. [I may here explain that a sepoy bathes by throwing a pot or two of water over his head, and then wiping himself dry with his cloth. His cooking utensils consist of a couple of brass vessels, in which rice is cooked and eaten; they are kept beautifully bright by being scoured with sand.] The second well has "no bazar or other permanent source of pollution in the neighbourhood."

I pause, and ask What is the common sense verdict on the above evidence? Two waters, by no means hard if we are to believe the soap-test results, containing a rather large amount of chlorides, a *notable amount of sulphates*, a minimum amount of oxidisable organic matter (0·0002 per 1000 of oxygen is the usual permanganate result in good wells), a small amount of nitric acid for India. Water of good physical properties, considered good by the people drinking it. Wells in perfectly satisfactory condition, neither of them very far from a tidal river (Fort William is on the banks of the Hoogly), in an alluvial delta. No source of pollution in the neighbourhood of one; in the other case, none beyond sepoys' quarters and a bazar. People wash near the well (as they do at every well in India).

Common sense verdict:—Good waters, somewhat affected by the saline deposits natural in an alluvial delta; No. 2 but slightly so. In neither case so much as to render them unfit for drinking if the people using them find them good.

Dr. Macnamara's verdict:—No. 2. "No doubt much of the saline matter in the well is derived from the washings of sepoys' bodies and cooking utensils." No. 1. "No doubt their neighbourhood [the bazar and sepoys' quarters], and the constant washing that goes on, not only of bodies, but of cooking utensils, in the vicinity of the well, is the reason of the impurity of the water."

The plain fact is, that Dr. Macnamara knows no other source of chlorine and nitric acid but animal excreta; he has never taken the trouble to ascertain how far washing, &c., at a properly constructed well will pollute the water in it; he has never observed the fact that the presence of sulphates is presumptive evidence of marine origin in the

chlorides present; he simply sees chlorine and nitric acid present, and though every other fact is dead against pollution of the well, he looks about till he sees a sepoy washing his body or his brass plates, and the explanation is found. On reference to the analysts' reports, I can find numerous instances where wells described as "surroundings very dirty," "everything connected with the locality of the well dirty in the extreme," contain less than 2 grains per gallon of chlorides. The slightest powers of observation would have shown Dr. Macnamara that, under an Indian sun (aided by Indian crows),* surface pollution, unless of the foulest character, does not affect the sub-soil water, while sub-soil pollution, such as that of cess-pits, &c., exercises a most striking influence. I render every justice to Dr. Macnamara's industry and zeal; he, however, lacks at least one qualification necessary to the analyst of waters, the faculty of observation.

What can be expected of analyses made according to the form I have quoted? Let any one compare the following points in them:—

	No. 1.	No. 2.
Total hardness, degrees	6·1	9·8
Lime calculated as carbonate, grains	18	10
Mag. carb. (by difference)..	11	4·5
Total insoluble earthy salts ..	29	14·5

These are analyses made by the author and superintendent of the system; the character of those made by the analysts can readily be imagined.

As a rule, the only waters that escaped condemnation were river waters, as they cannot contain nitrates in sufficient quantity to be detected by the rude qualitative estimation ordered by Dr. Macnamara, and no amount of pollution seems to increase their chlorides. But when we come to the wells, the havoc played amongst them by the analysts is terrible; with a few exceptions, they seemed to vie with one another in piling up sanitary horrors. Here is a specimen, taken at chance, of a well-water in a rather brackish district, as may be told at once by the quantity of sulphates present:—

Well No. 11, *Dinapore.*

Physical qualities	good	
Total hardness	8·47	
Permanent ditto	6·3	
Removable ditto	2·17	
Grs. of oxygen, &c., per 1000 grs.	·000125	
Ammonia..	present	
Phosphoric acid	traces	
Nitrous acid	present	
Nitric acid, grs. per gallon	about 17	
Total solids „ „	80·5	
Volatile matters	20·51	
Mineral matters	59·99	
Earthy salts and insoluble	36·05	
Lime calculated as carb.	25·34	
Silica	trace	
Soluble salts	23·94	
Chloride of sodium	13·44	
Sulphate of soda..	6·29	(23·54)
Carbonate of soda	3·81	

"The surface of the water in the well regularly littered with dirt. No care seems to be taken to keep the well even in a decent state."

Notwithstanding the terribly bad state of the well, as given in the remarks, the amount of oxygen by the permanganate is a minimum. But the remarkable points, analytically, are the vast amount of volatile matters, and the non-appearance of any of the nitric acid amongst the regulation "soluble" salts. There is also a slight want of coincidence between the hardness, 8·47° (it was evidently taken very accurately), and the 36·05 grains of calcium and magnesium carbonate. I think that this specimen, out of hundreds, justifies my using the term "skittles" as the only qualification that can be applied to Dr. Macnamara's system of water analysis.

One word more. Dr. Macnamara says: "If I were now instructed by Government to do over again the work lately done in Bengal, I should feel much inclined to put into the hands of the analysts Messrs. Wanklyn and Chapman's work on "Water Analysis," &c. This is no doubt very flattering to the gentlemen named; unfortunately, Dr. Macnamara had the very opportunity he mentions within three months of the date of his letter. At about that time, the officers who perform the ungrateful duties of water analysts in India received each, not a copy of Messrs. Wanklyn and Chapman's treatise and some apparatus to work it with, but a copy of Dr. Macnamara's own new scheme, consisting of a patchwork of forty-six processes acknowledgedly picked out of books and put together without even being tried. In this scheme, like the first, there is not a trace of practical acquaintance with Indian waters.

* The crows and ants consume everything eatable that is cast away; other refuse (and there is but little that crows and ants will not eat) is dried up by the sun.

ON THE TESTING OF MILK.*

By J. ALFRED WANKLYN,
Corresponding Member of the Royal Bavarian Academy of Sciences.

HAVING had occasion to examine a large number of specimens of milk during the past year, I have made some observations on the subject which possibly may not be deemed to be unworthy of the attention of those chemists who may have a like task before them.

The two common forms of malpractice which occur in the milk trade are—the practice of removing the cream from the milk, and the practice of diluting the milk with water; and the testing of milk resolves itself into the detection of skimming and watering, and the measurement of the extent to which these operations have been carried.

The possibility of detecting whether or not a specimen of milk has undergone impoverishment depends obviously on the possibility of assigning a normal composition to milk, or, at any rate, on the posssibility of fixing limits beyond which the composition of milk does not vary,

From the observations of Alexander Müller and Eisenstuck, who carried out an investigation for the Royal Agricultural Society of Sweden, it appears that the milk yielded by a herd of cows remains very constant in composition throughout the year. A daily analysis of the milk given by fifteen cows, of different breeds, but uniformly well fed, exhibited the percentage of solids in the milk as never once during the entire year having fallen so low as 11·5. The highest percentage of solids was 14·08. Only four times during the year did the solids fall below 12 per cent. The average was 12·8 per cent.

My own observations, made on an entirely different plan, fully bear out the statement that cows' milk does not fall so low as 11·5 per cent of solids, and seldom so low as 12 per cent.

The following analyses may be published:—

Date.	Description.	Percentages. Cream.	Solids dry at 100° C.	Ash.
I. 17 Feb., 1871	D. R.	10	12·24	0·76
II. 18 Feb., „	D. R.	—	12·04	0·68
III. 21 Feb., „	Cambridgeshire.	16	12·28	—
IV. „ „	Surrey.	11	12·22	—
V. „ „	Herts.	11	13·08	—
VI. „ „	Essex.	11	11·80	—
VII. „ „	Essex.	—	14·34	—
VIII. March, „	Country Milk.	9·8	12·45	0·71
IX. „ „	Town-fed Milk.	13·0	14·07	0·74
X. April, „	Alderney Milk.	11·5	12·65	0·70

The first two specimens, named D. R., were specimens of milk bought from milk dealers believed to be perfectly

* Communicated by the Author.

honest. The next five specimens were samples of milk produced on farms in the different counties named in the table. Specimen VIII. is a sample taken by myself out of some 50 or 60 gallons of milk fresh from the country. Taken altogether, the ten analyses represent the composition of an immense quantity, and of a great variety, of milk, and support the conclusion arrived at in Sweden by Müller and Eisenstuck.

Before leaving the subject of the normal composition of milk, it is right to refer to the laborious investigation by Goppelsröder (*vide* "Verhandlungen der Naturforschenden Gessellschaft in Basel," 1866), which, at first sight, would seem to be in opposition to the above.

In reference to Goppelsröder's paper, the remark should first be made that that chemist does not appear to deny that the solid residue in the milk of a herd of cows keeps constantly above the level just indicated. The point which he insists upon is, that the milk of a single cow sometimes falls in richness below the normal level, and observations are cited in support of this statement. An examination of the results given in his paper does not lead me to a similar conclusion. In his paper I find many determinations of the solids in milk believed to be unsophisticated. Only four out of the entire number fall below 12 per cent. Now it is obvious that, however constant milk may happen to be as a matter of fact, it must always be possible, by a sufficient multiplication of analyses, to exhibit an analysis showing the sample of milk as having a composition outside the normal limit of variation. In other words, there is such a thing as error of experiment, and the question to be asked respecting Goppelsröder's four isolated cases of milk showing less than 12 per cent of solids, is, whether this divergence from the standard composition is real or only an error of observation. Two of these instances occur in Table I., at the beginning of the paper. Among eighteen samples of milk, yielded by a single cow in eighteen consecutive days, he finds one sample yielding 10·69 per cent of solids, and another yielding 11·41 per cent. In the same table Goppelsröder records the percentage of cream, and the specific gravity of the milk before and after skimming. It is remarkable that the two low percentages of solids are not accompanied by low yields of cream or low specific gravities. The former of the two (viz., the 10·69 per cent of solids) is accompanied by 10 per cent of cream, sp. gr. 1·0316 before skimming, and sp. gr. 1·0332 after skimming; the latter (viz., the 11·41 per cent of solids) by 11·2 per cent of cream, sp. gr. 1·032 before and sp. gr. 1·034 after skimming. The third instance of a too-low solid contents is to be met with in Table III., being the evening milk given by the last of eight cows. Percentage of solids, 11·43; cream, 7·5 per cent; sp. gr. before skimming, 1·0315; sp. gr. after skimming, 1·0335. In this instance the cream is indeed rather low, but then the effect of skimming on the specific gravity of the milk is considerable, and the specific gravity is high.

It is perfectly true that if a little cream be removed from rich milk, and a little water (I believe it should be warm) be added to the milk, the creamometer and "lactodensimeter" may be cheated, so that there shall be want of correspondence between the indications of these instruments and the solids in the milk. But in the examples at present under discussion we are not dealing with skilfully sophisticated milk, but with milk in the natural condition as given by the cow. If the figures in the tables be correct, the cow must have, in these three instances, given milk not only abnormally poor in solids, but also in an abnormal physical condition, as if it had been manipulated by the fraudulent milk-dealer.

The fourth case of abnormally low solids occurs in Table IV., being the milk of the third cow, which is recorded as containing 9·54 per cent of solids. In this instance, unfortunately, the yield of cream is not given. The sp. gr. before skimming was 1·0279, but the sp. gr. after skimming is not given. I observe, moreover, that the next solid contents of the table is a misprint, viz., 3·7677 instead of 13·7677 (that it is a misprint is shown by the numbers for the ash and the number given as the ratio of the ash to the total solids).

I do not consider that Goppelsröder's four exceptional cases are sufficiently well established; and I consider it to be a well-established fact that the milk of a herd of cows in good condition always contains more than 11·5 per cent of solids, and that single cows almost invariably (if not always) yield milk containing more than 11·5 per cent of solids.

In dealing with milk supply on the large scale, we are little concerned with the possibility of single animals giving abnormal milk, and need only concern ourselves with milk of normal quality, all departures from the standard being looked upon as sophistications.

The following, which is the result of several concordant analyses of country-fed milk, may be taken as representing normal milk. In 100 grms. of milk:—

Solids (dry at 100° C.)	12·5 grms.
Water	87·5 ,,
	100·0

The 12·5 grms. consist of 9·3 grms. of "solids which are not fat," and of 3·2 grms. of fat.

If we consider the changes in composition which the addition of water to milk will produce, it will be apparent that it must diminish the proportion of solids in the milk, whilst the effect of skimming is to diminish the proportion of fat, and to leave the proportion of "solids not fat" unaltered (or indeed, strictly speaking, to make a very trifling increase in the proportion of the "solids not fat").

Treating the question quite rigidly, which I believe is the proper way of dealing with it, we arrive at the following:—

Problem I.—Given the percentage of "solids not fat" ($=a$), in a specimen of sophisticated milk (*i.e.*, milk either watered or skimmed, or both),—required the number of grammes of genuine milk which was employed to form 100 grms. of it.

Answer.—Multiply the percentage of "solids not fat" by 100, and divide by 9·3. Or—

$$\frac{100}{9{\cdot}3}a.$$

Problem II.—Given the percentage of "solids not fat" ($=a$), also the percentage of fat ($=b$), in a specimen of sophisticated milk,—required the number of grammes of fat which have been removed by skimming from the genuine milk which was employed to form 100 grms. of it.

Answer.—

$$\frac{3{\cdot}2}{9{\cdot}3}a-b.$$

In translating fat into cream, the rule is that a removal of 0·2 grm. of fat equals a removal of 1·0 grm. of cream. This rule is directly founded on experiment. I do not, however, claim a high degree of accuracy for the measurement of the cream.

Finally, a slight refinement may be noticed. If a specimen of sophisticated milk have been produced by both skimming and watering, it will be obvious, on consideration, that the extraneous water employed in manufacturing 100 grms. of it is equal to the difference between 100 and the quantity of genuine milk employed to make 100 grms. of sophisticated milk, together with a quantity of water equal to the fat removed by skimming.

$$\text{Extraneous water} = 100-\frac{100}{9{\cdot}3}a+\frac{3{\cdot}2}{9{\cdot}3}a-b.$$

$$=100-\frac{100+3{\cdot}2}{9{\cdot}3}a-b.$$

An investigation of the different milks supplied to the different London Unions (which was made by me for the Government, at Mr. Rowsell's instance, last year, and which is published in Mr. Rowsell's "Report on the System of Supply of Provisions for the Workhouses of the Metropolis"), will furnish an illustration of this method of interpreting the results of milk-analysis.

		In 100 Grammes of Sample of Milk.		Calculated.			
		Grms. of Solids not Fat.	Grms. Fat.	Grms. of Genuine Milk.	Grms. of Fat Removed.	Grms. of Cream Removed.	Grms. of Extra Water.
		a.	b.	$\frac{100}{9{\cdot}3}a$.	$\frac{3{\cdot}2}{9{\cdot}3}a-b$.		$100-\frac{100}{9{\cdot}3}a+\frac{3{\cdot}2}{9{\cdot}3}a-b$.
Bethnal Green (St. Matthew)	I.	9·04	1·22	97·2	1·89	9·45	4·7
,, ,,	II.	4·38	2·08	47·1	−0·57	−2·85	52·3
Camberwell (St. Giles)	I.	8·37	1·14	90·0	1·74	8·70	11·7
,, ,,	II.	8·94	0·96	96·1	2·12	10·60	6·0
Chelsea (St. Luke)	I.	9·36	2·24	100·6	0·98	4·90	0·4
,, ,,	II.	7·48	2·86	80·4	−0·28	−1·40	19·3
Fulham Union	I.	9·09	1·52	97·8	1·61	8·05	3·8
,,	II.	9·30	1·80	100·0	1·40	7·00	1·4
St. George's Union	I.	9·52	2·44	102·6	0·84	4·20	−1·8
,,	II.	9·08	2·82	97·6	0·31	1·55	2·7
St. George-in-the-East	I.	6·55	2·32	70·5	−0·06	−0·30	29·5
,,	II.	5·92	1·30	63·7	0·74	3·70	37·0
St. Giles-in-the-Fields and St. George, Bloomsbury	I.	9·13	1·50	98·2	1·65	8·25	3·4
	II.	7·17	1·96	77·1	0·51	2·55	23·4
Greenwich Union	I.	6·60	2·32	71·0	−0·05	−0·25	29·0
,,	II.	6·38	1·98	68·6	0·21	1·05	31·6
Hackney Union	I.	9·09	3·50	97·8	−0·47	2·35	1·7
,,	II.	7·40	2·54	79·6	0·00	0·00	20·4
Hampstead (St. John)	I.	8·44	1·50	90·7	1·40	7·00	10·7
,, ,,	II.	7·74	3·00	83·3	−0·34	1·70	16·4
Holborn Union	I.	8·27	1·84	89·0	1·01	5·05	12·0
,,	II.	7·64	2·40	82·1	0·23	1·15	18·1
Islington (St. Mary)	I.	7·70	0·92	82·8	1·73	8·65	18·9
,, ,,	II.	7·06	1·45	75·9	0·98	4·90	25·1
Kensington (St. Mary Abbott)	I.	8·04	0·60	86·0	2·17	10·85	16·2
,, ,,	II.	6·08	1·26	65·4	0·83	4·15	35·4
Lambeth (St. Mary)	I.	6·54	1·56	70·4	0·69	3·45	30·3
,, ,,	II.	7·08	1·22	76·1	1·22	6·10	25·1
Lewisham Union	I.	6·42	0·96	58·3	0·90	4·50	42·6
,,	II.	5·95	1·30	64·0	0·75	3·75	36·7
London (City of) Union	I.	8·84	2·82	95·1	0·22	1·10	5·1
,, ,,	II.	6·26	1·10	67·3	1·05	5·25	34·0
St. Marylebone	I.	7·84	1·14	84·3	1·56	7·80	17·3
,,	II.	9·44	3·06	101·5	0·19	0·95	−1·3
Mile-End Old Town	I.	9·55	1·96	102·7	1·32	6·60	−1·4
,,	II.	8·70	1·80	93·6	1·19	5·95	7·6
St. Olave's Union	I.	7·17	1·86	77·1	0·61	3·05	23·5
,,	II.	7·70	1·86	82·8	0·79	3·95	18·0
Paddington	I.	7·22	1·44	77·7	1·04	5·20	23·3
,,	II.	6·06	2·16	65·2	−0·07	−0·35	34·7
St. Pancras	I.	7·22	1·12	77·7	1·37	6·85	23·7
,,	II.	4·94	1·64	53·1	0·09	0·45	47·0
Poplar Union	I.	7·40	0·76	79·6	1·79	8·95	22·2
,,	II.	5·96	0·90	64·1	1·06	5·30	37·0
St. Saviour's Union	I.	6·65	2·10	71·5	0·19	0·95	28·7
,,	II.	6·30	1·90	67·7	0·27	1·35	32·6
Shoreditch (St. Leonard)	I.	9·99	1·48	107·4	1·96	9·80	−5·4
,, ,,	II.	9·44	2·36	101·5	0·89	4·45	−0·6
Stepney	I.	4·98	0·78	53·6	0·93	4·65	47·3
,,	II.	5·09	0·58	54·7	1·17	5·85	46·5
Strand Union	I.	9·56	1·64	102·8	1·65	8·25	−1·2
,,	II.	9·16	2·46	98·5	0·69	3·45	2·2
Wandsworth and Clapham Union	I.	8·78	1·50	94·5	1·52	7·60	7·0
,, ,,	II.	8·66	2·86	93·1	0·12	0·60	7·0
Whitechapel Union	I.	5·62	0·68	60·4	0·25	1·25	39·8
,,	II.	6·06	1·90	65·2	0·19	0·95	35·0

In column 1 is given the designation of the sample, viz., the name of the Union which furnished it, and the number of the sample.

In column 2 is given the number of grms. of "solids not fat" contained by 100 grms. of the sample.

In column 3, the fat.

In column 4, the number of grms. of genuine milk which was employed in making the 100 grms. of sample (calculated).

In column 5, the number of grms. of fat removed by skimming from 100 grms. of sample (calculated).

In column 6, the number of grms. of cream which had been skimmed off 100 grms. of sample (calculated).

In column 7 is given the number of grms. of extra water which had been put into 100 grms, of sample (calculated).

Inasmuch as I have submitted the analyses of these workhouse milks to severe and elaborate treatment, it is right that some particulars should be recorded concerning the manner in which they were conducted. The ash of each milk was determined, and in no instance was it excessive in amount, showing that no mineral had been used to adulterate the milk. For organic adulteration I made no elaborate analysis; but no indication of such adulteration presented itself in the course of the examination: furthermore, I should add that I have never yet met with a case of adulteration of milk with organic substances, and believe it to be of very rare occurrence.

The solid residue dry at 100° C. was taken with great —and I believe unprecedented—accuracy. I have made a study of the taking of milk-residues, and set down the average experimental error in the solid residue as not more than 0·02 per cent. The solid residues were taken twice over, and the mean of the two closely-agreeing determinations was employed in the construction of the table.

The facts were taken with great care, but they do not pretend to so high a degree of accuracy as the total solids. It is hardly necessary to add that the numbers (designated as a) in the column headed "Grms. of Solids not Fat" were obtained by subtracting the quantity of fat ($=b$) from the quantity of total solids dry at 100° C.

The calculation of the quantities of genuine milk employed in making 100 grms. of the samples is based on the assumption, which I believe to be warranted, that milk is tolerably uniform in strength, consisting of 9·3 parts "solids not fat," 3·2 parts of fat, and 87·5 parts of water. This is the composition of country-fed milk. There is, however, an exceptionally rich milk given by highly stall-fed cows in town. This milk contains 10·0 parts of "solids not fat," 4·0 parts of fat, and 86·0 per cent of water; but it is comparatively rare.

If, in any instances in the above table, this rich stall-fed town milk have been employed instead of average country milk, then the real amount of watering and skimming in those instances is a little higher than the table exhibits. In the table there are seven examples of more than 100 grms. of genuine milk being used in making 100 grms. of the sample. Of these one appears to be an example of this town-fed milk, the rest not being sufficiently above 100 to call for such a supposition. The example to which I refer is the Shoreditch milk, which on the first occasion yielded 9·99 per cent of "solids not fat," which is a very close approximation to the "solids not fat" in 100 parts of town-fed milk.

When a exceeds 100 a minus-quantity will correspond to it in column 7, unless the slight correction for fat obliterate the minus-quantity of water. On calculating for town-fed instead of for country-fed milk, the minus-quantities in column 7 will disappear in every instance. The calculation for town-fed milk instead of for country-fed milk, as in the table, is simple, viz., substitute $10a$ for $\frac{100}{9{\cdot}3}a$; substitute $0{\cdot}4a$ for $\frac{3{\cdot}2}{9{\cdot}3}a$.

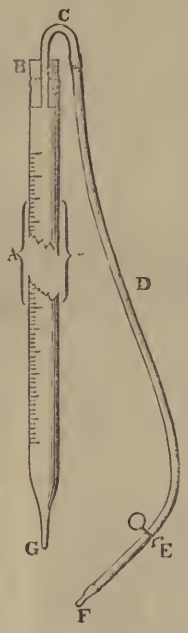
The occurrence of minus-quantities in the column headed "Fat Removed" requires a word of explanation. These minus-quantities have a real and substantial meaning. They are the quantities of fat which have been the reverse of removed,—that is to say, which have been added to the milk. Whenever one of these minus-quantities occurs in the "Fat Removed" column, one of three things has happened:—either the minus-quantity is within the limits of experimental error, as is the case with three of them (viz., −0·06, −6·05, and −0·07), or the milk was town milk, or the milk had through imperfect mixing received an undue share of the cream. There are only four cases of the kind in the table, viz., −0·57, −0·28, −0·47, and −0·34.

ON A

SIMPLE MODIFICATION OF MOHR'S BURETTE, TO ADAPT IT FOR ALL TEST-FLUIDS.

THOSE who are much in the practice of volumetric analysis with Mohr's burette must often have felt great annoyance at the necessity of changing the instrument when operating with certain tests such as permanganate and others which act chemically upon the caoutchouc connectors. The extreme simplicity of Mohr's, and the facility with which it can be used, renders it by far the most desirable instrument; and for this reason it has been attempted to obviate this defect by a glass stopcock, which, while adding considerably to the cost, is by no means satisfactory in use; remarks which equally apply to Binks's and Gay Lussac's forms of burette.

The difficulty has, however, just been overcome in a simple and thoroughly effective manner by Capt. Heriot, R.M., and Mr. R. Biggs, surgeon, of Bath; and we present our readers with a sketch and explanation of the arrangement adopted by these gentlemen.



A represents Mohr's burette, with the caoutchouc connector, pinch-cock, and delivery tube removed. B, a sound cork fitted with a bent glass tube, C, firmly fixed into the mouth of the burette. D, a piece of caoutchouc tube sufficiently long to reach the table, terminating in a small glass mouth-piece, F. The pinch-cock, E, is affixed to the tube D at any part most convenient to the hand of the operator.

The advantages claimed for this arrangement are as follows:—

(1). That one form of burette (and that the best, viz., Mohr's) is available for every test-fluid, as under no circumstances can it come in contact with anything but the glass tube.

(2). That however narrow, such burette can be readily filled without the admission of air bubbles, by simply immersing the lower end, G, in the test-fluid, opening the pinch-cock, and applying suction to the mouth-piece, F.

(3). The extreme ease with which the apparatus can be washed, without even removing it from the stand, it being only necessary to remove the pinch-cock, and produce a syphon by drawing a continuous stream of water through it.

(4). The readiness of application to existing burettes at nominal cost.

It may be well to mention that as by this arrangement the orifice G becomes the terminal dropping tube, it would be advisable in new instruments to constrict its diameter so as not to deliver too quickly; and also that

in cases where a narrow burette or pipette is used, the cork and glass tube may be dispensed with, and the india-rubber applied directly to its upper end.

DIFFUSION OF MERCURIAL VAPOUR.

By M. MERGET.

THE only labours whose object has been the diffusion of mercurial vapours are those of Faraday, which are already half a century old, and whose conclusions, never having been contested during this long period, are accepted as facts acquired by science. The illustrious English physicist is known to have used as a reagent a gold-leaf suspended over mercury, which would blanch by amalgamation, or preserve its colour according to the emission or non-emission of vapour. After two experiments, one positive, the other negative, and availing himself, moreover, of facts previously observed by Davy relative to the transmission of electricity in the barometric vacuum, he was led to form the two following conclusions:—

(1). That the phenomenon of vaporisation of mercury is not continuous, and that its production absolutely ceases below the limit of about 50°.

(2). That at temperatures above that limit, and for a portion of the thermometrical scale which is not indicated by him, the vapours emitted contrary to the general law of diffusion of elastic fluids form above the generating liquid a very thin layer of vapour, which at an ordinary temperature scarcely attains a few centimetres thickness.

These conclusions are, on one hand, in direct contradiction to empirical and theoretical formulæ; explaining the maximum tension of vapours of perfect liquids with regard to temperature, and which all tend to admit implicitly the theory of continuous evaporation; and, on the other hand, they are also at variance with the ideas which now obtain as to the composition and properties of elastic fluids.

Opinions at the present time are generally unanimous in regarding gases and vapours as composed of molecules which move with considerable rapidity; that rapidity as regards each, depending on its nature and its temperature. Vapours which, when once formed, possess all the general properties of gas, are explained to consist of a detachment of molecules from the mass of generating liquid, which escape from its open surface at an average rate of speed to a height which increases with their temperature, and whence, in falling, they acquire the same rapidity of descent.

Faraday's experiments do not appear to me so decisive either by number or exactitude, as to prevent all doubts as to their correctness; which might be aroused by their opposition to a theory so plausible as the dynamic theory of gases.

These doubts having led me to retrace them, my first care was to obtain a reagent more impressionable to mercurial vapours than leaf-gold. Several others can be substituted; and of these, the most sensitive are saline solutions of the precious metals.

When spread upon common paper, after the addition of hygrometric substances which retard their desiccation, these solutions are reduced by mercurial vapour according to the laws of Richter. The reduced metal again covers the paper, and communicates to it tints which become darker and darker, ending definitely in black; but of various tones according to the nature of the metals, and clearly characteristic of each.

The most common salts of the precious metals, such as nitrate of silver, the soluble chlorides of gold, platinum, palladium, and iridium, are those which have the best effect in the preparation of sensitive paper; moreover, as the sensibility of nitrate of silver is increased by the presence of ammonia through the action of that base upon the nitrate of mercury formed, it was thought that to render the nitrate of silver ammoniacal would be advantageous, and experience confirms the supposition. Ammoniacal nitrate of silver, with which a few traces are drawn with a pen upon common paper, is the best reagent; but since paper impregnated with it becomes slightly tinged in the light, and also changes in the dark, although slowly, its employment must be dispensed with in long experiments, or in those made by too bright a light, such as that of the direct solar ray. In such cases, substitution may be made of the chlorides of palladium and platinum, which are almost unalterable either photo-chemically or spontaneously. By employing according to circumstances one or other of these three reagent papers, I have established the following facts:—

(1). That the vaporisation of mercury is a continuous phenomenon, which is not interrupted even by the solidification of the metal.

(2). That the vapours emitted possess a considerable diffusive power, which, without being exactly measurable, does not apparently differ widely from the amount assigned to it, *a priori*, by the deductions of the dynamic theory of gases.

The second of these conclusions arises from experiments made in very large and lofty spaces, where I found, from the floor to the ceiling, mercurial vapour emitted from very feeble evaporating surfaces of that metal. The first is the result of numerous experiments made at all temperatures included between +25° and −26°C., and of four experiments made at the temperatures of −30°, −35°, −40°, −44°.

I may draw attention to a last point of resemblance between mercurial vapours and the other elastic fluids, namely, the property which they possess of being condensed by a certain number of bodies absolutely devoid of all chemical action upon them, such as carbon, platinum; and of penetrating with extreme facility such porous substances as wood, unglazed porcelain, &c. From the preceding facts, numerous deductions may be drawn, of which I shall indicate only the principal. I establish first, in the domain of chemical analysis, the increase of exactitude and sensibility given to the process of qualitative examination of mercury, by the employment of ammoniacal nitrate of silver. It is known that in those experiments where the wet process is employed, the formation of an amalgam determined by simple precipitation upon a sheet of copper, or electro-chemical precipitation upon a sheet of gold, the amalgam being recognised first by its white colour; and, secondly, by the disappearance of that colour when it is heated. If, however, the liquids to be tested do not contain a sufficiently considerable quantity of mercury, the changes produced are of too undecided a character to be of any service. In these cases where no trace of amalgamation is discernible by the eye, whatever test may be employed, it is only necessary to apply the sheet of copper or gold to ammoniacal nitrate of silver paper in order to obtain a brown colour characteristic of the presence of mercury. In this manner I was enabled to establish the presence of mercury in solutions of the bichloride at $\frac{1}{100000}$.

In experiments by the dry process, the mercurial vapours set at liberty were deposited upon the cold parts of the apparatus, where it was endeavoured to collect them into drops visible to the naked eye, or to the microscope; but this is not practicable if too small a quantity of mercury be employed. The slightest traces of vapour totally insufficient to yield a perceptible deposit, are, however, clearly shown by paper sensitised with salts of silver.

Reciprocally, the salts of precious metals are distinguished from all others by the effects of colouration, which result from their exposure to mercurial vapours; the shades of the darker tints which they then assume being to a certain extent characteristic of the kind of metal. Salts of platinum and of iridium, on account of the unalterability of the constituent metals, may be used to trace with pen or brush, not only on paper, but also on

the surfaces of all bodies incapable of chemically modifying them, characters or designs which, after reduction by mercurial vapours, are incapable of attack by almost all chemical agents.

The employment of these salts, together with mercurial vapour, is therefore an easy process for manufacturing indelible inks, suitable for writing or drawing on paper, linen, wood, &c. When formed with salts of gold, palladium, and silver, these inks, though less unalterable, may be used with advantage in particular cases.

Instead of using the solutions of these different salts as writing or drawing inks, they may be spread in thin layers upon common paper, and then exposed to the vapours emitted by drawings or characters previously mercurised. By thus reversing the question, I succeeded in resolving under new conditions, the problem of photographic impressions without light.

To do this it is only necessary to obtain a positive on glass, or even on paper suitably prepared with mercurial vapours, which are powerfully condensed by silver, and which it abandons when the plate is pressed upon a sheet of paper sensitised with a solution of one of the salts of the precious metals.

The proofs thus printed, when arising from a silver salt, are cleared and fixed by the usual photographic processes. When formed by salts of gold, palladium, platinum, or iridium, the clearing is naturally suppressed, and the fixing is obtained merely by washing in pure water. The proofs, after this unique and simple manipulation, are absolutely unalterable by light and all atmospheric agency. Moreover, those formed by reduced platinum or iridium are indelible, and cannot be destroyed except by such agents as will at the same time produce great changes in the substance of the paper upon which they are printed.

Substitution might advantageously be made for glass plates of metal sheets prepared for engraving, either by the application of photo-chemical processes, or by the graver, previously mercurising those portions of the sheet where the metal has been laid bare.

The permeability of porous bodies by mercurial vapour, allowed of my obtaining on sensitised paper impressions of leaves and plants; not only reproducing with irreproachable fidelity the finest details of the model, but causing them to stand out vigorously, by strong effects of contrast. When drawn from choice models, these impressions would make interesting collections of specimens for botanical lectures; and the process by which they were obtained might certainly be utilised in researches into vegetable anatomy and physiology. In animal physiology the study of questions relating to the effect of mercurials upon animal economy might be facilitated by the use of reagents which reveal the smallest traces of poisonous or medicinal agents, thus enabling their effects and mode of action to be more exactly studied.

A series of experiments made upon animals of small size, establish that mercurial vapours inhaled by them in open air are mortal in their effects. I therefore have commenced the study of this subject, which naturally bears much upon the health of those occupations into which the employment of mercury enters.

With regard to this subject, I will give an account up to the present time, of the general results of some observations made in a large workshop for silvering glass, occupying a large space, well ventilated, and all the appointments of which are perfectly appropriate for the carrying on of such an occupation.

In spite of the exceptionally advantageous hygienic conditions of these premises, I found that in the large apartment in which the mirrors received their coating, the atmosphere was at all times saturated with mercurial vapour from the floor to the ceiling; and that, although the workmen were in it only four hours a day, their skins, hair, beards, and all parts of their clothes were so strongly impregnated with condensed mercury, that even when not in the workshop, they were subject to the deleterious emanations of that metal. A means of relieving them from this perpetual salivation is indicated in my memoir. —*Comptes Rendus.*

PROCEEDINGS OF SOCIETIES.

THE SCIENTIFIC AND MECHANICAL SOCIETY, MANCHESTER.

Section I.—Engineering.

The fifth monthly meeting of the session of the above Society was held on Wednesday, the 2nd inst., at the Trevelyan Hotel, the Vice-President in the chair.

The following gentlemen were elected Members of the Society:—Messrs. R. L. Mestayer, C.E., C. J. Allport, M.E., Frank Spence, Peter Spence, John Gilchrist, Peter Hart, Ivan Levinstein, James Nalder French, Chemical Manufacturers; Theodore Grosse, Charles Waring, C. S. Allatt, Alexander McKenzie, Mechanical Engineers; E. A. Axon, Nathaniel Cartwright, and A. Esilman.

By the unanimous vote of those present, a member was expelled from the Society, in consequence of not having put in an appearance at the last meeting, when the duty devolved upon him of reading a paper. The Secretary received no reply to his communications to him, and the last was returned through the Dead-Letter Office.

The Hon. Secretary then reported that the Special Committee, which had been elected at the last meeting to devise some improvement and reorganisation scheme for the Society, had held four sittings, at the first of which it was decided that no decisive steps be taken until a sufficient number of efficient, experienced, and influential gentlemen, representing the Sections to be at present organised, were added to the Committee. Deputations were consequently appointed to wait upon gentlemen in the engineering and chemical profession, who succeeded to add Messrs. Mestayer, C.E., Allport, M.E., Frank Spence, John Gilchrist, I. Levinstein, P. Hart, and J. N. French (chemical manufacturers) as members to the Committee. At a subsequent sitting, it was resolved that Sections be formed—at least one additional, viz., Chemical Section; also, that a Reference Library, Reading-Room, and Museum be established, and that the meetings be so arranged that all Sections meet on different days, so that each member might attend any meeting he pleased. It was hoped that other Sections would be formed in due course. The next business of the Special Committee would now be to construct as efficient a code of regulations as could possibly be done, and that was at present under consideration; and at the next Monthly Meeting, which was also the General Half-Yearly Meeting, the Committee would be prepared to lay a complete arrangement before the Society for approval. The Committee thought it also desirable that the Society should be known under a more suitable name in future; but, as the utmost importance was attached to this consideration, no resolution had as yet been come to.

The Chairman then called upon Mr. Hacking to read his paper "*On the Ventilation of Mines.*" He said there were now about 33,000 coal mines in the United Kingdom, from which the enormous quantity of 120,000,000 tons of coal were raised annually. The depths at which these black treasures, constituting such an all-important ingredient in the wealth of this country, were stored varies very much, the deepest workings in this country being the Dakinfield and the Rosebridge collieries, near Wigan, which latter had a depth of 2418 feet, and the average temperature was about 95° F. The danger attending the getting of coal was very great; this was partly due to the peculiar position in which the miner was placed, and partly to the terrible agencies reigning at these depths. A great difficulty was to obtain an efficient supply of pure

air, for which mechanical means had almost invariably to be adopted. A very common mode of ventilation was by means of one, two, or three shafts; at or near the bottom of one, the upcast, a fire was kept, which rarefied the air above, in consequence of which new air rushed in from the downcast, which had to make its way through the workings, and lastly to the fire.

The life of those employed in the pits was much endangered by what was called "fire-damp," which was light carburetted hydrogen (C_2H_4) mixed in certain proportions with oxygen, or, what is the same, atmospheric air. The gas itself, which issued from the pores and crevices of the coal, was inexplosive, but if atmospheric air contained more than 7½ per cent, and less than 13 per cent, the results were most terrible; if that mixture came in contact with a naked flame it would then explode. The supply of pure air was therefore required to be very ample, in order to keep the mixture below the explosive point. As a rise in the barometer indicated a decrease in the pressure of the atmosphere, a larger quantity of the gas would always be liberated when such a rise took place, and he suggested registering-barometers, which might be made to actuate an alarm as a safeguard.

Mr. HACKING was just alluding to the use of fans for ventilation, when the time arrived at which it was arranged the subject should drop, and be continued at a meeting in the ensuing session.

Mr. LYNDE then introduced the discussion on Sir William Fairbairn's new patent high-pressure boiler, which he illustrated by a good photograph and sketches on the black board, confining his remarks, however, to structural arrangements only. The boiler—which is intended to carry much higher pressures (about 150 lbs. on the square inch), as has hitherto been attempted in the Lancashire and Cornish boilers—is already tolerably well known to scientific readers, illustrations and descriptions having appeared in "The Engineer" (April 19th) and other journals. It is essentially what is technically known under "French boiler," "Woolf boiler," "Elephant boiler," or "Bouilleur boiler," with this material difference, however, that each of the two bottom tubes have internal flues containing the fire-grates, the same as a Lancashire boiler. These flues, which form an annular water-space through the whole length, are so arranged that for the purpose of cleaning, by loosening a few bolts, they may be withdrawn from the tubes, which latter are about 3 feet in diameter, communicating with one another. The entire circular shell constitutes heating surface.

Numerous questions were asked with regard to constructive detail, relative value of evaporating surface, &c., but the object of the discussion being merely to ventilate the opinion and probable experience of the members, but few questions could be satisfied, no paper having been prepared for the purpose. Various advantages and drawbacks were pointed out, but no defined decision was come to.

Votes of thanks to Mr. Hacking, Mr. Lynde, and the Chairman, terminated the proceedings.

CORRESPONDENCE.

NEW PROCESS FOR ANALYSING COMPOUND ETHERS.

To the Editor of the Chemical News.

SIR,—I think all chemists will agree with me that the publication of nearly 100 analyses, made according to a certain process, including several special control analyses showing the accuracy of the process, is something more than a mere "abstract statement that compound ethers admit of having the alcohol which they yield to alkalies measured or weighed."

The successful application to quantitative analysis of the above well-known reaction was, I believe, new in 1867; it certainly was not new in 1872.

I hope Prof. Wanklyn will not be offended if I express a belief that I have induced at least one chemist to use my process; and as we all know how ably and perseveringly this chemist brings forward any method once adopted by him, I live in the pleasing hope that my process will soon be used by chemists generally, and, at any rate, am quite contented to let the matter rest here.—I am, &c.,

A. DUPRE, PH.D.

MISCELLANEOUS.

Food Adulterations Act.—The Vestry of Lambeth, at its meeting on Thursday, October 10th, appointed Dr. Muter, F.C.S., to be the Public Analyst for the Borough.

New Works by Professor Galloway.—Professor Galloway, of the Royal College of Science, Dublin, has two works nearly ready for the press. The title of one will be—"How the Natural Sciences are Taught, and how they ought to be Taught; with a Scheme for rendering more efficient the Government Science Schools." The title of the other will be—"A Manual of Applied Analysis."

Dublin Exhibition.—The Executive of the Exhibition Palace have determined upon introducing popular lectures, of a sound educational character, into their programme. They have been inaugurated by Prof. Cameron, the City Analyst, who is now delivering a series of twelve lectures on "Sanitary Science." We have no doubt that, in the hands of that talented Professor, they will prove a success, more particularly as they are being well illustrated by experiments. They are delivered twice a week, on Mondays and Fridays, in the large Concert Hall. As illustrating the character of these lectures, we will give the Syllabus of the fourth lecture, delivered on Monday, the 14th inst.:—Atmospheric Dust; Organisms in the Air; The Germ Theory of Disease; The Question of Spontaneous Generation, considered in Relation to the Origin of Zymotic Diseases.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, October 7, 1872.

This number contains the following original papers and memoirs relating to chemistry:—

New Experiments Made for the Purpose of Proving that the Yeast Germ which Induces Fermentation in Grape-Juice is Derived from the Outer Skin of the Grapes.—L. Pasteur.—In this memoir the author states that oxygen alone does not excite alcoholic fermentation in saccharine liquids. The reading of this paper at the meeting of the Academy gave rise to an animated debate.

Generation of Ferments.—E. Fremy.—Replied to by MM. Dumas and Pasteur.

New Facts Relating to the Theory of Fermentation Properly so-called.—L. Pasteur.—Reserved for full translation with the observations made by M. Fremy.

Researches on Crystalline Dissociation; Alums.—P. A. Favre and C. A. Valson.—The continuation of a monograph on this subject, elucidated by several tables exhibiting results of experiments.

Efficacy of Lightning-Conductors.—W. de Fonvielle.—A report of the author's researches on this subject, and his journey to England for the purpose of learning what experience had been gained here respecting the efficacy of lightning-rods in protecting buildings against injury from electric discharges.

Action of Borax in the Phenomena of Fermentation.—M. Béchamp.—This paper records the results of a series of experiments made to show the effect of a concentrated (at 18°) solution of borax upon yeast and upon zymase (water obtained from the washing of yeast) when in contact with a sugar solution. First series—I. Sugar-water (1 of sugar to 6 of water), 5 c.c.; yeast-water, 10 c.c.; after fifteen minutes reduction of the cupro-potassic reagent. II. Sugar-water, 5 c.c.; yeast-water, 10 c.c.; distilled water, 10 c.c.; reduction after fifteen minutes, but less strong than in I. III. Sugar-water, 5 c.c.; yeast-water, 10 c.c.; borax solution, 10 c.c.; no reduction after twenty-four hours, but evident reduction after thirty-six hours. IV. Sugar-water, 5 c.c.; yeast-water, 10 c.c.; borax solution, 20 c.c.; no reduction after forty-eight hours. From this and two other series of similar experiments, the last being made with boracic acid instead of borax, the author comes to the conclusion that the boracic acid is not the cause of the peculiar action of borax on the fermentation; while he has found that the action of bicarbonate of soda is in a manner similar to that of borax. It is incidentally observed that the addition of one drop of creosote to 100 c.c. of fermenting liquid impedes neither the fermentation nor the interversion of the sugar.

Determination of the Vegetable Substances Present in Potable and in Insalubrious Waters.—E. Monier.—This paper contains the record of the results of a series of experiments made with various kinds of previously-filtered water, titrated at a temperature of from 85° to 90° with a solution of permanganate of potassa, in order to oxidise the organic matter present in a given quantity of water, or, in other terms, to decompose a certain quantity of the permanganate. 1 litre of the water of the river Dhuys decomposes 0·5 m.g.; 1 litre (unit) of the water of the Seine, at Bercy, 4·5 m.g.; same river, at the Pont Royal (Paris), 5·7; at Clichy, near Asnieres (sewer), 11·0 to 18·0; at Saint Ouen, 7·6; at Saint Germain, 7·4; at Poissy, 5·1.

La Revue Scientifique de la France et de l'Etranger, October 5, 1872.

This number contains no original papers relating to chemistry, but we call attention to the proceedings of the Sections for physics, astronomy, geodesy, mechanics, anthropology, and engineering, of the late Bordeaux meeting of the French Association for the Advancement of Sciences.

The First Century of the Belgian Academy.—F. Papillon.—From this paper we quote the following dates of foundation of scientific societies in Europe:—Rome, 1603; Del Cimento, Firenze (Florence), 1651; L'Académie des Curieux de la Nature, 1652, at Schweinfurt, by Dr. Bausch; Royal Society, London, 1645, as a private meeting; Royal Charter, 1660; Paris, 1666: Berlin, 1741; Bruxelles, 1792.

October 12, 1872.

This number contains no original papers relating to chemistry, but we notice the following:—

Scientific Journey to Bordeaux.—E. Alglave.—Under this title valuable and interesting information is given concerning the wine-production, industry, and commerce of the district.

Annales des Mines, No. 3, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Changes which the Sulphurous Waters of Eaux-Bonnes (Département des Basses Pyrenées, France) Undergo when in Contact with a Limited Quantity of Air.—L. Martin.—The contents of this memoir may be summarised as follows:—The sulphurous water of Eaux-Bonnes (a hot spring; temperature, 31°) when admitted into reservoirs, and left there in contact with a limited supply of air, exhibits two successive reactions—the first is the rapid conversion of monosulphuret of sodium into its bisulphuret, with formation of an equivalent of silicate of soda; the second is the gradual conversion of the bisulphuret of sodium into hyposulphite of soda, by fixation of oxygen. The water in the reservoirs contains constantly all the sulphur in the condition of bisulphuret of sodium and hyposulphite of soda; no sulphuretted hydrogen is given off, nor are any higher sulphurets formed. The water contains exactly 2 equivs. of silica to 1 equiv. of sulphuret of sodium; and the above-mentioned silicate, formed by the alteration of the water when in contact with air, is a quadri-silicate. The water is conveyed to the reservoirs from some distance, and is used for bathing purposes; it contains the total quantity of sulphur present in the original water, but in the state of monosulphuret of sodium mixed with hyposulphite of soda.

Palæontological Essay on the Lower Oolite of the Limits of Southern and South-Western Central Plateau.—Dr. Bleicher.

Note on some Minerals from Chili.—E. Bertrand.—The author describes the following minerals:—Bordosite, so named from the locality in which it is found, consists of chloride of silver, and chloride and oxide of mercury; in 100 parts—AgCl, 31·23; Hg_2Cl, 45·53; HgO, 22·70. An arseniuret of copper, which is malleable and whitish-yellow coloured, contains 7·5 per cent of arsenic. Jalpaite, a sulphuret of silver and copper; in 100 parts—S, 14·02; Ag, 71·63; Cu, 13·06; Fe, 0·57.

New Silicate of Lime.—A. Piquet.—The mineral alluded to occurs at Sierra de Carija, in Spain, at a distance of 8 kilometres N. of Merida, in a quarry from which phosphate of lime is obtained. The percentical composition of this mineral is as follows:—Lime, 46·410; magnesia, 1·301; alumina, with a trace of oxide of iron, 1·561; silica, 48·356; sulphuric acid, 0·562; carbonic acid, 1·000; water, 1·111; potassa, trace. The sp. gr. of this mineral is 2·799; its formula is $2SiO_3CaO$.

Separation of Iron from Manganese.—J. P. de Rezende.—Reserved for full translation.

Annalen der Physik und Chemie, von Dr. J. C, Poggendorff, No. 9, 1872.

This number contains the following original memoirs relating to chemistry and collateral subjects:—

Experiments Made with the View to Determine the Course of the Bumerang.—W. Stille.

Mineralogical Communications.—G. vom Rath.—The eleventh portion of this monograph, this section treating on an orthite; illustrated by engravings.

Influence of the Stiffness, Mode of Fastening, and Amplitude on the Vibration of a Chord.—F. Braun.

Spectra Exhibited by Phosphuretted Hydrogen and Ammonia.—Dr. K. B. Hofmann.—Illustrated by engravings.

Evolution of Light by the Motion of Atoms.—F. Hoppe-Seyler.

Nitric Anhydride (Salpetersäures Anhydrit), and a New Hydrate of Nitric Acid.—R. Weber.—In the introduction to this paper the author refers at some length to the researches of Deville, Odet, and Vignon on the anhydrous nitric acid prepared by the action of chlorine upon dry nitrate of silver, and also to the earlier experiments of Thenard, Gay-Lussac, and others for dehydrating strong nitric acid by means of sulphuric acid. The author next describes at length a series of experiments which show that, after having prepared a concentrated nitric acid by re-distilling several times a mixture of strong nitric and concentrated sulphuric acids by the action of pure phosphoric anhydride (care being taken to keep the nitric acid cold by means of ice applied to the vessel wherein it is contained) nitric acid may be obtained in the solid anhydrous crystalline state. This substance has a sp. gr. of 1·64; it is rather prone to spontaneous decomposition, especially at a somewhat high temperature (above 10°); sulphur, phosphorus, and the readily oxidisable metals (potassium and sodium) act upon this anhydride energetically, but carbon, aluminium, zinc, cadmium, iron, nickel, titanium, copper, lead, tin, bismuth, antimony, tellurium, and thallium are quite passive with this substance; pure clean silver and palladium are not acted upon by it, but metallic arsenic and mercury are oxidised. Upon many of the organic substances this nitric anhydride acts strongly, and it combines with water in the same way as hydrosulphuric acid; it also combines with strong nitric acid, forming a peculiar hydrate, a crystalline substance, consisting of—Nitric acid, 92·31 per cent; water, 7·69. Formula, $2NO_5+1HO$.

Behaviour of some Alkaloids Towards Sugar and Sulphuric Acid.—R. Schneider.—After briefly referring to Schultze's discovery that several protein compounds and also some fatty oils exhibit a peculiar purplish colour when mixed with sugar and sulphuric acid, the author states that he has found that several alkaloids—Morphia, codeine, narcotine, and narceine—behave in a somewhat similar manner when brought into contact with sugar and sulphuric acid; but the cinchona alkaloids and strychnia, brucia, atropine, colchicine, emetine, and picrotoxine do not exhibit such a reaction; atropine assumes a rose-red colour under the same conditions; delphinine turns at first yellow, but soon becomes brown, and, upon the addition of a single drop of water, of a beautiful green colour; chelidonine treated with sugar and sulphuric acid yields a colouration somewhat like that exhibited by strychnia when treated with sulphuric acid and bichromate of potassa.

Contributions to Micro-Mineralogy.—Dr. von Lasaulx.—The second part of a monograph on this subject.

Dynamical Theory of Gases.—V. Lang.

Les Mondes, October 10, 1872.

Theory of Fermentation.—Prof. Pasteur.—From the abstract here published it appears that the celebrated *savant* has recently found that saccharine liquids (must from grapes, malt infusions, &c.) do not enter into alcoholic fermentation solely by contact with oxygen, but that the introduction of germs or dust (*poussière*) present upon the fruit of the vine is absolutely required to cause fermentation; this fact is experimentally demonstrated by the description of the mode of operating. The author also briefly alludes to some recent researches made by him, from which he draws the conclusion that two different orders of living beings exist in Nature—one of which, visible to the naked eye, requires free oxygen for sustenance; while the other, microscopically small objects, is killed by free oxygen, but lives upon that drawn from any of its combinations, carbonic acid for instance. Fruit (apples, pears, peaches, &c.) continues to live after being pulled from the trees which produced it, and, while exposed to free circulation of air, absorbs oxygen, exhales carbonic acid, and ripens. When fruit is exposed to an atmosphere of carbonic acid, this kind of life ceases, and the fruit, being prevented from absorbing oxygen, begins to assimilate oxygen from its own juice (saccharine material), the result of which is that a veritable alcoholic fermentation is set up, whereby the fruit becomes soft, and yields, on being submitted to distillation, pure alcohol, while carbonic acid is given off. This communication is as yet a preliminary one, since the researches are not yet complete.

International Congress for Weights and Measures.—Rev. F. Moigno.—The author states that great progress has been made for the definitive adoption of the metric system as a universal international system, and that the members of the Congress agree on all really essential points.

Petites Annales de Chimie.—E. J. Maumené.—The seventh portion of this monograph, elucidated by a series of algebraical and chemical formulæ, and intended to simplify the theory of chemistry according to certain views of the author.

Caravane Universelle.—Captain Bazerque.—Under this title the author publishes an exhaustive programme of an intended scientific exploration of the different parts of the world, aided by all the means that science, industry, and commerce can supply, for the purpose of furthering friendly intercourse between different nations and tribes, as well as for geographical, meteorological, and other scientific objects.

Universal Carcel Lamp with Double Air-Draught and Compensation.—Rev. F. Moigno.—The author briefly describes a new kind of oil-lamp, constructed upon very inproved principles by A. Bernard and Co., Paris, which, when applied without reflector, gives a light equal to that of thirty standard candles, and, with reflector, a light equal to that of fifty. Having been tried as a signal-lamp on board a French man-of-war, it has been found, with a slight alteration in the burner, to yield a light distinctly visible at a distance of 10 French sea-miles = 55·555 metres = about 34·5 English statute miles.

Bulletin de la Societe Imperiale des Naturalistes de Moscou, No. 1, 1872.

It rarely happens that this periodical, which is chiefly devoted to natural history, contains an original paper relating to chemistry; we find, however, in this number the following memoir:—

Researches on the Compounds of Ilmenium and Niobium, and on the Composition of the Niobium-Containing Minerals.—R. Hermann.—This is the first part of an exhaustive monograph on this subject, elucidated by a series of formulæ, and divided into the following sections:—Preparation of $\dot{N}b\dot{N}b_2$ and of $\dot{I}\dot{I}_2$ from a mixture of columbite and ferro-ilmenite from Haddam; separation of the acids of niobium and ilmenium by fractional crystallisation of their potassium fluorides, and preparation of their soda salts; composition of the metallic acids contained in the Schuchardt's mineral powder; soda salts of the niobium acids; soda salts of the ilmenium acids; atomic weight of niobium; specific gravity of niobium and its atomic volume; brown niobium oxide; green niobium oxide; niobium oxide, (NbO); niobous acid, (Nb_2O_3); hyponiobic acid, (NbO_2); niobic acid, (NbO_3); niobium sulphuret, (Nb_2S_3); niobous chloride, (Nb_2Cl_3); niobous oxychloride, ($Nb_2(O+nCl)_3$); yellow niobium chloride, ($NbCl_3$); niobium and fluorine; combinations of fluor-niobium and fluor-potassium; combinations of potassium-niobium-ilmenium fluoride; fluorides of niobium and sodium; combinations of fluor-niobium and ammonium fluoride; fluor-niobium and fluor-zinc; fluoride of copper and fluoride of niobium; compounds of the niobium acids with bases, viz., potassa, soda, ammonia, magnesia, oxide of iron, oxide of copper, protoxide of mercury, and oxide of silver.

Journal für Gasbeleuchtung und Wasserversorgung, Nos. 16 and 17 (double number), 1872.

Tessié du Motay's Gas-Lighting Method.—E. Mack.—From this brief report of the author's lecture we learn that important improvements have been made by B. Andreae in the preparation of oxygen, and the gas-burners have been so altered as to admit of the oxygen flowing out towards the periphery of the coal-gas flame. It further appears that at Vienna, and in other parts of the Austro-Hungarian Empire, this method of gas-lighting is also generally approved of in consequence of its small expense.

There is published in this number the detailed description, illustrated by several engraved plates, of an experimental gas-work devised by the committee of the German Association of Gas-Managers appointed to report on this subject.

Polytechnisches Journal von Dr. E. M. Dingler, first number for September, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Application of the Papin Digestor for Culinary Purposes.—Professor Junichen.—This paper treats on the use which might be made of the so-called Papin digestor under high pressure, for the purpose of boiling meat and other food. From a tabulated form added to this paper, it appears that the author's experiments prove that the time for cooking various articles of daily consumption is very much shorter when effected under strong pressure, while a great saving in fuel is also obtained.

Analysis of Crystalline and Amorphous Bottle-Glass.—Dr. H. Schwarz.—The crystalline variety (obtained from Siemens's glass-works at Dresden) contained, in 100 parts—Silica, 58·65; alumina, 7·22; peroxide of iron, 2·03; protoxide of manganese, 5·68; lime, 15·18; magnesia, 0·31; soda, 9·97; potassa, 1·03. Formula—

$$16SiO_3,2Al_2O_3,13RO.$$

Amorphous glass contained, in 100 parts—Silica, 59·33; alumina, 7·69; peroxide of iron, 1·89; protoxide of manganese, 6·30; lime, 14·13; magnesia, 0·35; soda, 9·70; potassa, 1·36. Formula—

$$17SiO_3+2Al_2O_3+13RO.$$

The sp. gr. of the crystalline glass was found to be, at 15°, 2·660; that of the amorphous, 2·648.

Venetian Mosaic Glass.—Dr. H. Schwarz.—A sample of the bright blue-coloured Mosaic glass, from Salviati's celebrated works, was found to consist, in 100 parts, of—Silica, 64·70; alumina, 2·0; peroxide of iron, 0·54; oxide of antimony, 5·92 (the semi-opacity of this glass is due to this substance); oxide of lead, 9·76; oxide of copper, 1·32; lime, 3·04; potassa, 2·05; soda, 9·98.

Decolorising Action of Animal Charcoal.—Dr. H. Schwarz.—This essay records the results of a series of experiments made with the view of ascertaining whether, by igniting bone-ash with organic substances, such as glue, size, sugar, &c., a good decolorising charcoal is formed, and also whether the spent animal black can be revivified to its former strength by a similar process. It appears from the author's extensive researches that animal black may be entirely revivified in closed vessels by ignition with organic matter, which need not be nitrogenous.

Quantity of Manganese Contained in Various Kinds of Steel.—Dr. F. Keszler.—Krupp's cast-steel contains from 0·437 to 0·438 per cent of manganese; Bochum cast-steel, from 0·312 to 0·317; Hasper steel, 0·327 to 0·332; Hörder steel, 0·167 to 0·170; Krupp's cannon steel, from 0·185 to 0·207; Ludwig's (at Berlin) manganese steel, 0·303 of manganese and 0·31 of silicium; English pig-iron (Askam and Millorn, Cumberland), from 0·080 to 0·105 of manganese; piano-wire made from best Swedish iron, 0·035.

Studies for Establishing a Scientifically-Arranged Tanning Method.—A. Reimer.—The conclusion of this monograph; this portion is divided into the following sections:—On the part which the different portions of the skin play in the process of tanning (tawing) with alum and common salt; coriine with alum and common salt; the fibres of the cellular tissue; general conclusions to be drawn from the researches; tanning experiments with iron alum and chrome alum; skin and iron salts; experiments with oak tannin (quercotannic acid), general conclusion; the behaviour of skin towards tanning materials, and that of animal fibres towards dyes. The behaviour of charcoal with dyes and tanning materials belong to that class of phenomena which are designated as surface attraction *(Flächen anziehung)*.

NOTES AND QUERIES.

Transparent Cement.—I should feel greatly obliged if you would kindly tell me the ingredients used to make a liquid transparent cement to stand hot water.—Omicra.

Constituent Fatty Acids of Palm-Nut Oil.—(Reply to F. H. T. A.)—This correspondent will find the information he requires in Wagner's "Chemical Technology," recently published by Messrs. J. and A. Churchill.

Sugar-Refining.—Works on Organic Chemistry.—Would your readers kindly inform me where I can find the best information about the modern methods of sugar-refining; and what are the best works on organic chemistry, especially in regard to recent research, for a student who is well acquainted with Miller's third volume?—A. J. W.

Fusion-point of Cæsium.—(Reply to Dr. W. Hall.)—It appears that cæsium has not yet been obtained in free metallic state; an amalgam with mercury has been formed; the equivalent weight of cæsium (Cs) is 133.

TO CORRESPONDENTS.

T. Fletcher, C. T. Kingzett, L. Browne, R. Apjohn, G. Ainsworth, W. Baxter, Prof. Galloway, Prof. Henry Morton, E. Sonstadt, C. R. C. Tichborne.—Received with thanks.

Percolator.—We have often given processes for protection of wood from fire. Consult Index; also No. 669, Sept. 20th.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 674.

CHEMISTRY IN INDIA.

Complaints are often made (and it must be admitted that there is some reason for them) that, on the occurrence of vacancies, chemical appointments in England are not always given to the most distinguished chemists who apply for them. What, however, should we think if the chemical chair in a first-rate hospital in London were given, not to a chemist by profession, but to a medical man who was supposed to know a little chemistry? What would be said if our friend Mr. Roberts were to be replaced at the Mint by a general medical practitioner? and if the testing of the metropolitan gas were to be handed over to some member of the medical faculty supposed to have chemical proclivities?

Such things are done in our Indian Empire, where, in addition to the many calls upon the medical profession, there falls the burden of supplying professorships of chemistry in medical colleges, chemical examinerships, assay-masterships, inspectorships of gas-works, and the like. The medical profession, although a most learned profession, cannot satisfactorily discharge all these functions. We are informed, moreover, that in one notorious instance all the offices which we have just enumerated are undertaken, not by several members of the faculty, but by one solitary medical practitioner.

The state of things in India may be imagined by such of our readers as may happen to know what a medical school used to be in times gone by, when chemistry was taught from books that stated "a stream of sulphuretted hydrogen throws down a dark green precipitate from the solution of copper." Our readers will be inclined to add that, in this instance, the green is very dark, and that it is commonly called brown or black.

It is not beyond the bounds of possibility that such a book may be in the hands of some of those medical gentlemen who have undertaken to act as chemists in India. We are in possession of details respecting the manner in which chemical operations are conducted in India, which show that, whether or not the book from which we have quoted be received as a text-book, there is imminent need of reform.

It should be known that the Indian Government set up cinchona plantations at Ootacamund, in the Madras Presidency, and at Raungbee, in Sikhim, Bengal, for the laudable purpose of supplying the fever-stricken millions of India with cheap quinine. Someone found it to their interest to lead the Madras Government to suppose that an admixture of inferior alkaloids did not cause deterioration of the quinine, and that consequently it might be hoped to supply an "amorphous quinine" at one shilling the ounce. Such hopes were, of course, delusive, and the Government are furnished with a substitute for quinine, consisting of a mixture of unbleached alkaloids, containing 18 per cent of pure quinine, 54 per cent of cinchonidine, 13 per cent of cinchonine, the remainder being colouring matter, &c. This mixture, it appears, is supplied at a cost which, according to various accounts, is from 60 to 80 per cent of that of the best quinine, and at a considerable loss on the real market value of the drug. The constitution of the Raungbee drug is reported to be even still worse, since the presence of quinine was quite cast in the shade by that of *copper* to the extent of at least *ten per cent.* But even for India this was too much, and the works have been placed under the care of a new superintendent, from whom we may hope to obtain at least a purely vegetable product.

The question may be asked, whether the chemical appointments are sufficiently well paid to induce talented chemists to seek them; and in reply it can be stated that, with a salary of £1000 to £1200 a year, and a healthy hill climate with a mean annual temperature of 54° F., India offers a fair field to every English chemist who is willing to go there.

ON THE MANUFACTURE OF PURE SULPHATE OF POTASSIUM.

By E. SONSTADT.

Most of the sulphate of potassium known in commerce consists essentially of the double salt $3K_2SO_4+Na_2SO_4$. According to Dr. Penny's investigations, this salt, when its solution is repeatedly crystallised, affords crops of salts of variable composition, but in which "plate sulphate" and sulphate of sodium predominate. M. E. Peligot, on the other hand, in a paper, "Sur la Répartition de la Potasse et de la Soude dans les Végétaux," * proposes, as an analytical method, the separation of the sulphate of potassium and sodium by crystallisation, and in respect to plate sulphate makes the following remark:—"J'ajouterai que les sulfates doubles des potasse et de soude ne se produisent que dans des conditions exceptionelles tellement rares, que M. Des Cloizeaux a eu beaucoup de peine à s'en procurer quelques échantillons. C'est surtout lors de la cristallisation des sulfates, en présence d'une liqueur alcaline contenant du carbonate de potasse et du carbonate de soude, que ces sels ont été quelquefois obtenus. Ces conditions se trouvent réalisées dans les urines où l'on raffine les potasses provenant des salins de betteraves." M. Peligot's own results do not appear to have been subjected to the control of analysis, he contenting himself solely with reference to the crystalline form of the salts obtained, and to their character as to efflorescence in air.

About three years ago I was induced—by the difficulty I experienced in obtaining pure carbonate of potassium, free from sodium, in commerce, fit to be used in the manufacture of iodide of potassium—to experiment upon the manufacture of a pure sulphate of potassium from plate sulphate. These experiments cost me nearly a year's labour, and were conducted not only in the laboratory, upon small quantities, but also at works where a few hundredweights could be treated at a time. The statement made by Peligot, that plate sulphate can only be crystallised from an alkaline solution, is not correct. Plate sulphate crystallises from perfectly neutral solutions of sulphate of potassium, containing a certain proportion either of sulphate of sodium or of chloride of sodium. But a solution of pure plate sulphate (sodio-tripotassic sulphate), when slightly concentrated, so as to give only a very small crop of crystals on cooling, deposits pure sulphate of potassium. If the liquid is saturated when hot, and allowed to cool, the crop of crystals obtained consists chiefly of plate sulphate. By repeated crystallisations crops are obtained chiefly of potassium sulphate, containing less sodium sulphate than plate sulphate, with

* *Annales de Chimie*, December, 1867.

occasional crops of plate sulphate and of sodium sulphate towards the last. These results, therefore, agree substantially with those obtained by Dr. Penny. I tried also "salting out" continuously from a boiling solution of plate sulphate, and found that the sodium accumulated in the salts separated during heating, but only up to a certain point. I also alternated these modes of treatment in many ways, but still unsuccessfully, so far as concerned the effective separation of the sodium from the potassium sulphate. Having failed in these attempts, I studied the mutual influence upon one another of the chlorides and sulphates of sodium and of potassium in promoting or retarding one another's solubility, and the experiments soon led to the process of purification indicated by the equation—

$$3K_2SO_4+Na_2SO_4+2KCl=4K_2SO_4+2NaCl.$$

In practice, 664 parts plate sulphate are added to as much boiling water as will dissolve the whole; 149 parts chloride of potassium are then added to the hot solution by small portions at a time. As the chloride of potassium dissolves, pure sulphate of potassium precipitates as a crystalline powder. The liquid is allowed to cool, when more pure sulphate of potassium crystallises out. The mother-liquid is then evaporated until it becomes saturated at boiling temperature, and, on cooling, deposits another crop of pure potassic sulphate; and this process may be repeated three or four times, until the liquid becomes saturated with chloride of sodium, after which any further crops obtained would be chiefly of plate sulphate. When the muriate used in this process contains, as it usually does, a few per cents of plate sulphate, this small proportion of plate sulphate does not dissolve, but becomes mixed with the first crop of pure sulphate, and as some mother-liquor adheres and dries up upon the sulphate, the latter, in practical working under ordinary conditions, may contain as much as 3 per cent of sodium sulphate, equal to nearly 1 per cent of sodium. When the chloride potassium used is pure, as in laboratory experiments, and the sulphate obtained as described is carefully washed free from the mother-liquors, it is pure. But in practice, when—as in the manufacture of iodide of potassium—a perfectly pure potassic sulphate is required, it is better to re-crystallise the sulphate first obtained, which is then chemically pure.

These experiments have been controlled throughout by carefully-executed analyses of the salts obtained. In the earlier analyses made in the course of the investigation the sulphuric acid and the potassium were separately estimated; but in the later analyses only the sulphuric acid was estimated, and the atomic weight of the base thence deduced, in the absence of chlorine. In the sulphate of potassium that I have described as pure the atomic weight of the potassium—calculated from the sulphate of barium obtained—was usually 39·13, and rarely fluctuated more than between 39·1 and 39·2. In these analyses certain precautions must be taken,—especially that the solution of the specimen of sulphate of potassium should be *dilute*, and that the chloride of barium should be added all at once in *slight* excess, and be quickly stirred up. With these precautions the sulphate of barium precipitated is quite pure, after proper washing with pure water.

ON A MEANS OF PREVENTING EXPLOSIONS IN COAL MINES.

By JOHN A. R. NEWLANDS, F.C.S.

Diminished atmospheric pressure is frequently followed by the escape of fire-damp into the workings of a colliery. To obviate the risk incurred by such barometrical changes I propose that artificial means should be adopted, so as to maintain the atmospheric pressure within a given mine always at one and the same level, and also, if desired, to work under a somewhat increased atmospheric pressure. Taking the case of a mine having a downcast and an upcast shaft, the mouth of each of these should be covered over by an air-tight chamber, capable of withstanding a moderate pressure either from within or without. This air-tight chamber might be conveniently constructed of sheet-iron, provided with thick glass windows: it should also be made sufficiently large to admit of all the usual operations at the pit's mouth being conducted within it. The shaft of the engine used for raising coal would pass through the sides of this air-tight chamber, so as to move the necessary hoisting apparatus within. Connected with this air-tight chamber an air-tight room should be constructed, provided with two sliding doors, the inner door separating it from the air-tight chamber, and the outer door preventing contact with the external atmosphere. It will be seen at a glance that when the outer door of the room is shut, and the inner open, the room becomes part and parcel of the air-tight chamber, so that any truck laden with coal might be run from the air-tight chamber into the room, and then (by closing the inner door of the room and opening the outer) on to the ground surrounding the pit's mouth, without sensibly altering the pressure within the pit itself.

To produce the requisite current of air for ventilating the pit the air-tight chamber over the downcast shaft should be connected with powerful air-pumps, worked by steam, so that a continuous current of fresh air might be forced through all the workings of the pit before finally escaping through a pressure-valve from the air-tight chamber over the upcast shaft. Any required degree of ventilation, or of increased atmospheric pressure, could thus be produced within the pit. As no fire would be wanted in the upcast shaft, it would be available for hoisting coal, &c. The air supplied to the mine might, if required, be easily cooled, by compressing it in cylinders surrounded with cold water before allowing it to pass into the pit, and thus the temperature of the pit might be reduced to any extent. The air issuing from the pit should be chemically tested at stated hours, and whenever the fire-damp appeared to be increasing the men and horses should be brought up, and the air-pumps should be employed in drawing air out of the mine, so as to diminish the pressure within, and thus cause any imprisoned marsh-gas to be brought out of its hiding-place. After keeping the mine under diminished pressure for some hours, a rapid current of air should be driven through the workings, and when—by testing the air passing through the escape-valve—it was found to be nearly pure, operations could be safely recommenced.

9, Mincing Lane, E.C.,
October 21, 1872.

CHEAP SALINE DISINFECTANTS.

By SIDNEY W. RICH.

A Paper read by Mr. E. C. C. Stanford at the last meeting of the British Pharmaceutical Conference, has induced me to make the following remarks. The paper alluded to was entitled "A Cheap Disinfectant," and affected to demonstrate the superiority of chloride of calcium as a disinfectant over hydrochlorate of alumina and other saline disinfectants. Although I give no tabulated experimental results, I may state that the remarks I now make are based on the experience derived from a large amount of experimental labour devoted to a study of the relative power of these salts when applied to animal and vegetable solids and fluids, and also sewage.

The number of cheap saline disinfectants found efficacious under ordinary circumstances, may be counted on the fingers. The chlorides and sulphates of iron,

aluminium, calcium, and sodium, complete the list. A few words devoted to each of these may help to give a clear idea of their respective values.

The chloride and sulphate of sodium are simply preventive, or antiseptic, although in a less degree than the free acids. They have no disinfecting or absorptive power. The extensive use of chloride of sodium (common salt), is due partly to its cheapness and convenient form, and partly to the fact that it has always been an article of commerce and domestic use.

Sulphate of calcium (gypsum) has long been used as a disinfectant, more particularly on farms and in stables. Its absorptive action is very considerable, both in respect to ammoniacal products, and, in a mechanical way, of the other products of decomposition. Owing to its slight solubility, however, it has no great action as a preventive, and the same reason confines its use to the disinfection of solid matters. It cannot be used for fluids, or allowed to enter the drains.

The value of chloride of calcium as an antiseptic is about equal to that of common salt, but it possesses, beyond, the power of absorbing the ammoniacal products of decomposition, and to that extent a disinfecting power. It has, however, no power to absorb mechanically the other products of decomposition.

The sulphate of aluminium and hydrochlorate of alumina are powerful disinfectants and antiseptics to an extent beyond any of the bodies of which we have yet spoken. As antiseptics these salts are nearly, if not quite, as efficacious as the acids themselves, while free from the objections which attach to the use of the latter. Their absorptive action is exerted on the ammoniacal products of decomposition; and also by virtue of the mechanical action of the hydrated alumina, which is precipitated immediately these salts are brought in contact with decomposing matter, or the other products of the said decomposition. The solubility and harmlessness of these salts renders their use admissible under all ordinary circumstances; while the lightness of the precipitate of alumina secures immunity from any danger of choking the drains. The hydrochlorate of alumina appears to be somewhat more powerful than the sulphate of aluminium.

The chloride and sulphate of iron have all the action of the corresponding aluminium salts, and, beyond, they possess the power of absorbing the sulphuretted products of decomposition. This latter fact places these salts at the top of the list in respect to efficacy. There are, however, some objections to the use of these salts, the principal being that when used in large quantities for ordinary purposes, the iron itself is likely to be injurious to the vegetation with which the fluid or other matter may ultimately come in contact.

Apart from the question of price, the conclusion to be derived from the above observations is manifestly as follows. That the greatest efficacy and general applicability will be found in a solution containing hydrochlorate of alumina with a small quantity of chloride of iron. The hydrochlorate of alumina will serve to do the general work of a disinfectant and antiseptic, while the iron salt will absorb the sulphuretted compounds which arise from the decomposition of some kinds of organic matter.

The chloride of calcium is the cheapest, inasmuch as it is a waste product in all alkali works. In this particular, hydrochlorate of alumina will, however, be able to compare favourably in the future as the result of late improvements in the manufacture of alum will be to cause the manufacture of large quantities as a waste product.

In recommending chloride of calcium as a disinfectant, Mr. Stanford recommends that the solution should contain 25 per cent of the solid salt, acidified with 12 per cent of hydrochloric acid. Certainly, such a solution would have a considerable disinfecting power, but most chemists would attribute this to the hydrochloric acid. Moreover, a solution containing 12 per cent of hydrochloric acid would be a very disagreeable fluid for ordinary purposes.

THE EARTH SALTS OF BELLARY.

By EDWARD NICHOLSON,
Assistant Surgeon, R.A.; Analyst of Waters, Mysore, Northern and Ceded Districts.

THE soil of the Ceded Districts yields three saline products—salt, nitre, and soda. I have lately examined the first two of these in the course of my investigations on the peculiar salinity of wells sunk in black cotton soil.

Salt.

Any person who has been in Bellary must have remarked mounds of black cotton soil here and there about the outskirts of the cantonment. These mounds are raised for the purpose of being worked for earth salt; when exhausted they are abandoned, and become gradually levelled by the scanty rain of years. They are generally situated not far from the lines of drainage of the country at any convenient spot where the soil is saline, and water can be easily obtained. Patches of the most saline earth, tested in a simple manner by application to the tongue, are dug up and heaped in a mound 10 or 12 feet high; at different levels of the mound funnels are excavated and lined with beaten earth, and the loose earth being placed in these is gradually exhausted by repeated washings. The water having been sufficiently charged with salts in its passage through the different funnels, is run on to a level floor of rammed earth surrounded by a low rim. Under the influence of Bellary sun, evaporation is effected in a few days, and a residue of salt is left. This is piled in heaps for any moisture (bittern) to drain off, and when dry, it is sold to the villagers for domestic consumption. The wholesale price is about 30 seers (measure) for a rupee; it is retailed at about eight cash per seer (a penny per quart), which is half the price of sea-salt. It is not usually sold in cantonment, as it is never used by the population of sepoys, camp followers, and other people not belonging to this part of the country, its use seems to be entirely confined to the villagers.

Bitter flavour is sometimes alleged by the camp population as the reason why this salt is not used, but I am inclined to think that the dislike is more caused by prejudice against the source of the salt.

I have examined several specimens of earth salt, and found them to differ very widely in composition, some being of considerable purity, whilst others contained as little as 44 per cent of sodium chloride. In some cases I found that the fresh salt consisted of perfectly pure and white crystals of sodium chloride bathed in a mother-liquor of deliquescent calcium and magnesium salts, principally nitrates with some chlorides and sulphates. Either washed with cold water and then dried, or pressed between folds of blotting paper, the crystals were much purer and whiter than any sea-salt; but before this cleansing, a distinctly bitter flavour was imparted by the mother-liquor.

One specimen was brought to me by a man who engaged largely in the manufacture, as a fair specimen of the salt produced in his district. This I subjected to complete analysis. When air-dried it still contained 3 per cent of moisture; it was of slight alkaline reaction, clean, but of white effloresced appearance without any regular crystals. Exsiccated, it had the following composition per cent:—

Sodium chloride	44·50
Sodium sulphate	49·30
Magnesium sulphate	4·93
Magnesium nitrate	0·24
Magnesium carbonate	0·35
Calcium carbonate	0·70
Insoluble (sand, clay, &c.)..	0·45
	100·47

A person consuming daily the moderate amount of a quarter of an ounce of this salt would take along with the real salt a quantity of sodium and magnesium sulphates (anhydrous), equal to 121 grains of Glauber's salt, and 12 grains of Epsom salt. I do not think that difference of taste would warn people against this. Magnesium chloride, nitrate, and sulphate are very bitter, so also are calcium chloride and nitrate, and the presence of these in the mother-liquor adherent to crystals of salt would give a decided unpleasant flavour. This is not, however, the case with sodium sulphate; its taste is not very disagreeable, and in this sample it seemed to be entirely concealed by that of the chloride. A slightly bitter after-taste arose from the magnesium salts present.

The purification of the different samples of earth salt would have to be done in various ways, differing according to their respective composition. Those which consisted of pure salt coated with the deliquescent earthy nitrates and chlorides, could easily be purified by simple washing with a little cold water; but this would not do in the case of the sample containing a large quantity of sodium sulphate. If the quantity of sodium sulphate and other foreign salts did not exceed one quarter, the best plan would be to lixiviate the salt gradually with an equal quantity of hot water. But when, as in the case of the above sample, the quantity of sodium sulphate amounts to fully one-half, the purification would be best done in the following manner. Wash the salt with a very small quantity of hot water to remove magnesian and other deliquescent salts; then, the salt having cooled, add to it an equal quantity of the coldest water; the sodium chloride will dissolve to the extent of 40 parts in 100 of water, whilst the sodium sulphate will dissolve much more slowly and in a quantity inversely proportionate to the coldness of the water. 100 parts of water take up 10 parts at 60° F., 15 parts at 68°, and 20 parts at 77°. The colder the water the less sodium sulphate will be taken up; the residue will consist entirely of this salt, whilst the chloride can be recovered by boiling, in a much purer condition. The residue might possibly be utilised for the manufacture of carbonate of soda by calcination with kunkur and charcoal.*

The brackishness imparted by this salt to many of the wells sunk in the black cotton soil is different in character from that arising in consequence of "previous sewage contamination." In Bangalore, where, owing to the porousness of the soil, whole districts of the station are saturated with the mineral products of excrementitious infiltration, the salts found are quite distinct; sodium chloride, earthy (calcium and magnesium) chlorides and nitrates appeared in quantities varying from 50 to 300 centigrammes per litre, but I never found the slightest increase in the small amount of sulphates normal in the Bangalore subsoil water. Whatever the character of the water they always remained low—about 0·4 to 0·6 centigamme per litre. In Bellary, out of the influence of the black cotton soil, the subsoil water does not differ materially from that of Bangalore, and like it, contains a very small proportion of sulphuric acid; but the quantity of this constituent increases rapidly as the wells approach the black cotton soil—10 to 30 centigrammes are not uncommon, and one well yielded as much as 153 centigrammes (equal to 227 centigrammes per litre, or 159 grains per gallon of sodium sulphate).

The sulphates are accompanied by a proportionate quantity of chlorides, and invariably by some nitrates. The latter are in lesser proportion, as it is not usual in the water of uncontaminated soils for the amount to exceed 2 centigrammes per litre. These saline waters are not very hard, the greater part of the salts being alkaline (sodic) rather than earthy. Sodium chloride and sulphate are the principal salts present, earthy chlorides, sulphates, and nitrates, being in considerably smaller proportion. The distinguishing characters between these saline waters and waters charged with the mineral traces of sewage may be thus tabulated:—

Saline Water from Black Cotton Soil.	Saline Water from Polluted Soil.
Much chlorine— 40-100 c.grm. per litre.	Much chlorine— 20-120 c.grm. per litre.
Much sulphuric acid— 10-150 c.grm. per litre.	Little sulphuric acid— Under 1 c.grm. per litre.
Nitric acid variable— 1-5 c.grm. per litre (rarely more).	Nitric acid large if not exposed to air and vegetation— 10-30 c.grm. per litre.
"Permanent" earthy salts present; never greater than "removable" earthy salts.*	Very much permanent earthy salts; generally largely in excess of removable earthy salts.

In many cases the liquor extracted by the salt makers from the black cotton soil approaches very closely to sea-water in its composition, only differing materially by the presence of nitrates; the product of evaporation is hardly distinguishable from bay salt. The occurrence of sodium sulphate would seem to distinguish the mixture of salts from that found in sea-water, as that substance does not exist in sea-water; but its presence in earth washings is readily explained when we remember that any sodium silicate or carbonate existing in the soil would decompose the earthy sulphates of marine origin; insoluble earthy silicates or carbonates and soluble sodium sulphate being the result. And it is to be remarked that the soils which produce salt do not produce soda, the presence of the earthy sulphates that accompany the salt preventing apparently the soda being produced as it otherwise would be.

A peculiarity of the marine deposits (as I believe they are) diffused through the black cotton soil country is their tendency to accumulate in the lines of drainage; not only about dry watercourses at the low level of valleys, but also nearer to the larger drainage system of the country. I am informed that, in some parts of the Ceded Districts, wells near to rivers give, as a rule, brackish water, quite contrarily to what one would expect. The reason of this is probably to be found in the very partial washing which the soil undergoes from the scanty rainfall. The salts are washed from the soil of the higher tracts of country, but by the time the subsoil drainage water has percolated to the lower parts of the valleys, it is much nearer to the surface and the cessation of rain with the force of evaporation causes the salts to stop on their journey towards the sea.

In connection with this subject two points may be noted:—

(1). These sulphated waters readily evolve sulphuretted hydrogen when in contact with wood. Sojourn in a tub for one night causes most Bellary water to smell offensively by the next morning. This should not be confounded with "putridity," as it too often is in sanitary documents.

(2). The sulphates and chlorides appear to be inimical to vegetable life when repeated irrigation has caused garden soil to become charged with these salts; but in more moderate quantity the sulphates have a beneficial effect on plants requiring much sulphur, leguminous and cruciferous plants for instance. Bellary onions are well known for their excellence and abundance; it is possible that they flourish in consequence of being so freely supplied with the sulphur necessary for the formation of their essential oil.

* One cannot, however, but be astonished that the manufacture of this culinary salt should be continued, in spite of its impurity and the small pecuniary advantage in its use, now that the railway passes through the Ceded Districts. I believe that Government loses a large amount of revenue owing to the substitution of this earth salt for sea salt.

* I use these terms derived from the soap-test purely for convenience, meaning by "removable" earthy salts the carbonates and silicates of calcium and magnesium correctly ascertained. Boiling does not remove them, however; a water may be entirely free from "permanent" earthy salts (chlorides, sulphates, nitrates), yet show after boiling considerable permanent hardness. Evaporation to dryness and re-solution, give far more correct results.

Nitre.

Nitrates are invariably found in well-waters derived from subsoils of decomposed felspar or of clay. Ammonia, whether that normally found in the atmosphere, or that produced by organic decay, becomes oxidised when in contact with porous soil, and in presence of bases with weak acids—such as silicates and carbonates—it changes into nitric acid, and expels the weaker acid. As there are few soils that do not contain silicates and carbonates of either potassium, sodium, magnesium, or calcium the presence of nitrates is nearly universal, and we would naturally expect to find them in the washings of the salt-mounds. The filtration of water through soil containing silicates or carbonates would generate nitrates even if none were present originally. I found as much as 1·5 per cent of nitric acid in the solid residue of a sample of earth washings, a quantity equal to 176 centigrammes per litre of the fluid; and the moisture adhering to the crystals of salts subsequently obtained was highly nitrous. The nitrates present in the earth-washings are always the deliquescent nitrates of calcium and magnesium; the sodium salt being excluded in consequence of earthy sulphates and chlorides having already decomposed any sodium silicate or carbonate that would otherwise have been available for the saturation of nitric acid as it is formed. Potassium being comparatively of rare occurrence in these soils is excluded also from combination as nitrate. The nitrates existing in every sample of earth-washings that I have examined are consequently wasted; while if the mother-liquor of the salt crystals were treated with wood ashes, or other convenient source of potash, the earthy metals would be replaced by potassium, and nitre would be obtained. The quantity, would, it is true, be not more than 2 or 3 per cent of the common salt obtained.

The nearest place where I could find nitre to be regularly made was at Sirragirri, about 20 miles north of Bellary. From the account given me of the process by the nitre maker of Sirragirri, it would appear that earthy nitrates are never utilised, and that soil containing potassium nitrate already formed is the only kind worked. To obtain nitre at once in this condition, in a country where potassium salts are rare in the soil,* the nitre maker must confine his operations to soils in the neighbourhood of villages, selecting those spots where, from infiltration of urine, from the drainage of cattle sheds, or from the vicinity of ash heaps, the earth has become artificially supplied with potash. Considering that Indians generally use the manufacturing processes which are best adapted to circumstances, and which, though rude, are quite as profitable to them as the more ingenious but more expensive processes of European industry, I am rather surprised that the addition of potash to earth-washings containing earthy nitrates is not practised in India as it is in Europe. The earth-washings are allowed to evaporate as in the manufacture of salt, and any earthy nitrates are lost in the mother-liquor. The nitre is obtained tolerably clean, in small prismatic crystals mixed with the cubic crystals of common salt; this impurity varies from 6 to 20 per cent, or more. If required refined, it is purified by solution and re-crystallisation, a most wasteful process under the circumstances, as about 30 per cent of the nitre is lost.

The impure nitre is sold at one rupee per maund of 24 lbs.; when purified, the same quantity costs one rupee twelve annas. This very low price is, I think, occasioned by the nitre being too impure for shipment, and the manufacturers are not acquainted with the processes of refining economically. The nitre might be bought and refined at a total cost of not more than 12s. per cwt., it being worth 28s. to 30s. at home. Ignorance of economical refining processes affords the only explanation of the low prices obtained for an article of such value. To refine it economically it would be necessary to accumulate a large quantity; mix it well, and determine from an analysis of a sample the process to be adopted for its purification. The process applicable to a nitre containing only 5 per cent of impurity would be quite inapplicable to another sample containing 40 per cent of impurity.

* The greater part of the soil of India is produced by decomposition of metamorphic rocks,—gneiss, basalt, trap,—the felspar contained in these are principally soda felspars.

Soda.

I have not been able to meet with any instance of this salt being produced near Bellary; that sold in the Ceded Districts is made, I believe, near Cuddapah. The sodium carbonate, of which the impure soda principally consists, is the result of the decomposition of sodium silicate by atmospheric carbonic acid. Silicic and carbonic acids are about of equal strength, and it entirely depends on circumstances which acid can expel the other from its combinations. Silicic acid expels carbonic acid from solutions, whilst carbonic acid acting in excess, and for long periods of time, expels silicic acid from solid silicates. In parts where the soda is produced it is found principally as an efflorescence on the surface, the sodium silicate of the soil having evidently been decomposed by atmospheric carbonic acid. Its presence is incompatible with that of earthly chlorides, sulphates and nitrates; and as these are constantly found accompanying the salt and nitre yielded by black cotton soil, it is evident that the production of salt or nitre excludes that of soda.

Natural sodium carbonate does not appear to be produced in India to any considerable extent, perhaps little in excess of the limited requirements of washermen.*

The main features of the production of these earth salts may be thus summarised:—

Salt is derived from marine deposits in the black cotton soil. It may be mixed with the following impurities:—

(1). Marine earthy salts, principally magnesium chloride and sulphate.

(2). Sodium sulphate, produced by the decomposition of marine sulphates by sodium silicate.

(3). Nitrates, principally of magnesium and calcium.

Nitre does not accompany salt as such (as potash nitre), but indirectly as earthy nitrates. Potash nitre can only be obtained from soils to which potassium salts have been added accidentally or purposely. Soils containing the nitrified products of decayed animal matters are alone profitable to work; even in these there is great loss unless potassium salts be added.

Soda is produced in soils by the action of carbonic acid on the sodium silicate of decomposed felspar rocks. Both the carbonate and the silicate of sodium being decomposed by the soluble earthy salts which invariably accompany salt and nitre, soils yielding the latter salts cannot yield soda.

FLUORESCENT RELATIONS OF ANTHRACENE AND CHRYSOGEN.

By HENRY MORTON, Ph.D.,
President of the Stevens Institute of Technology.

In the course of an investigation of the fluorescent spectra of certain organic and inorganic substances, some of the results of which have just been anticipated by Becquerel in a memoir presented to the French Academy (see *Comptes Rendus*, vol. lxxv., p. 296), I was led to study pretty thoroughly the properties of anthracene in this connection, and have arrived at certain results which are new, and possibly of some moment in their bearing upon

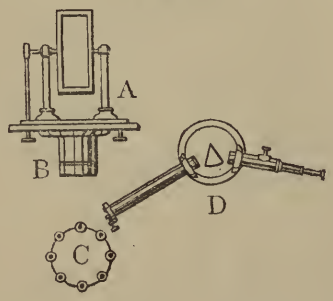
* For many years there has been advertised a machine warranted to produce ice by the aid of two salts indigenous to India, and procurable everywhere at a cheap rate. The two salts are sal-ammoniac and carbonate of soda. Most possessors of these frigefactive engines can give doleful accounts of their searches in the bazar after the last named salt.

the discrimination between that substance and some of the associated bodies.

In the first place, it should be noticed that anthracene is ordinarily procurable in several forms, either as—(1) a dark olive-green crystalline fused mass or (2) a green-grey powder, both these being its crude state; (3) as a light brown flaky powder, in which form it is imported from the best German chemical manufacturers under the title of chemically pure anthracene; (4) as a snow-like powder with a faint yellow tinge, in which condition it can readily be obtained by distillation in a current of air; or (5), lastly, as a mass of pearly scales, also with a tinge of yellow, in which form it is readily obtained by crystallisation on cooling from a solution in alcohol saturated at the boiling-point.

In any of these forms, when placed in the path of a beam of sunlight (see Fig. 1), condensed by a lens, and passed through a tank containing ammonio-sulphate of

Fig. 1.



copper in solution, and then examined by a spectroscope, anthracene yields a spectrum (of which Fig. 2 is a rough drawing) consisting of four bright bands, separated by dimmer, but not absolutely dark, spaces. The first of these bands is of red colour, the second of orange and yellow, and the other two green.

The dark space dividing the red from the orange is narrow and faint compared with the others, which, even in the lightest form of the material, as mentioned above, are strongly marked. The striking persistence of this fluorescent spectrum, in face of the great change in optical appearance of the substance itself, is curious, and furnishes a ready means of recognising this body under the endless variety of tints and structural conditions which it assumes.

In his admirable work, entitled "La Lumiere" (vol. i., p. 382), Becquerel notices, among other "phosphorescent" bodies, an "hydrocarbon having the colour of the uranium salts, and obtained from Fritzsche." He also gives the spectrum of this substance, as seen when "excited" in his phosphoroscope. No measurements are furnished, but the bands are shown in their relation to the Fraünhofer lines, and in this regard the correspondence with the spectrum shown in Fig. 1 is so close that I should have little hesitation from this alone in believing that Becquerel's hydrocarbon was anthracene; but when it is remembered that anthracene, under the name of photene, was first studied by Fritzsche, the inference becomes much stronger.

While writing the above, I received the last number of *Poggendorff's Annalen* (1872, No. 7), and there find the remarks by E. Hagenbach on the above subject, in which he states that his examination of a minute fragment of photene or anthracene obtained from Wöhler leads him to the conclusion that it differs from that used by Becquerel.

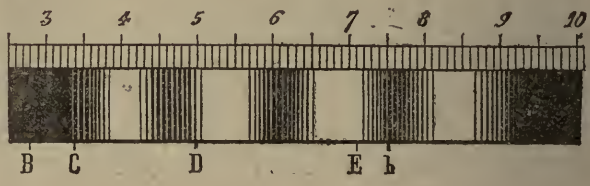
As, however, I find a perfect agreement in the position of these bands in specimens of anthracene obtained from several foreign and American sources, and in all sorts of conditions resulting from various treatment, it seems to me clear that Becquerel's material is identical with what is now known in commerce as anthracene.

We naturally inquire, in the next place, whether this spectrum is due to pure anthracene or to some intimately associated impurity. To settle this it was necessary to obtain some chemically pure anthracene.

After many trials, I found that, among all the processes recommended by Kopp in his excellent article in the *Moniteur Scientifique-Quesneville* (1871, p. 536), none would produce a body pure enough to bear this delicate optical test, except that of exposing the hot solution to sunlight. I, however, used the solution in alcohol with, I think, better results than benzine, which is recommended by him, as in this case no notable amount of para-anthracene was formed. The substance thus obtained yielded a pretty blue fluorescence, but one much less brilliant than that of the partially pure variety, and this, when examined with the spectroscope, showed *a continuous spectrum*.

In all its general properties, this substance agreed with that prepared by distillation and repeated crystal-

Fig. 2.



lisation from hot alcohol, being like it made up of pearly-white scales, reacting chemically as pure anthracene should. In fact, the two forms are not to be distinguished except by this optical test.

It can therefore, I think, be safely concluded that pure anthracene does not give a banded spectrum by fluorescence, and that the spectra given by Becquerel and Hagenbach, as well as that shown in Fig. 1, belong to some associated body.

Before leaving this part of the subject, I would remark that, if a solution of anthracene in hot alcohol is allowed to cool to about 80° F., it will deposit a crop of crystals, which seem to carry down nearly all the fluorescent colouring matter, so that those deposited by cooling it further to 32° F. will be far lighter. The special state of aggregation also has a marked effect upon the intensity of the fluorescence; the flakes deposited from a solution in cooling, or the crystals obtained by evaporation, being much more active in this respect than those obtained by distillation, or rather sublimation. A white powder, obtained by adding water to the alcoholic solution, has also in some cases no easily appreciable fluorescence, and the first specimen which I prepared by exposure to sunlight had so little fluorescence that I described it at first as equal only to that shown by white paper. Other specimens, however, similarly prepared, gave the delicate blue fluorescence above mentioned.

Considering, next, what was the origin of the fluorescent light which gave the banded spectrum, we find that Fritzsche gives the name chrysogen to a yellow substance accompanying anthracene, which is soluble in ether, is destroyed by exposure of its hot benzole solution to sunlight, and of which a quantity too small for analysis was isolated by him (*Comptes Rendus*, vol. liv., p. 910).

This is, without doubt, the substance whose spectrum is found in all the forms of anthracene first enumerated, and in the material examined by Becquerel.

In addition to the *fluorescent* spectrum furnished by impure anthracene, or rather, we should say, chrysogen, it gives a very characteristic absorption-spectrum, showing two strongly-marked bands, a less defined one, and a total extinction of all rays above 13·8 (see Fig. 3).

To obtain this, it is best to distil some of the crude green anthracene in a current of air (see CHEMICAL NEWS, vol. xxv., p. 165) at a rather high temperature, so as to get a yellow product, then to wash this thoroughly with cold alcohol, which removes a brownish yellow material, yielding no absorption-bands, and little, if at all, fluorescent.

The material now left may be spread on filter-paper and examined by transmitted blue light, as shown in Fig. 4; or it may be mixed with melted paraffin and

FIG. 3.

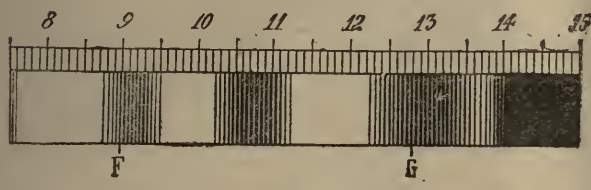
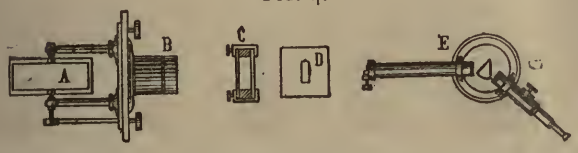


FIG. 4.



spread on glass, or fused between slips of mica or glass, and examined in the same way. The absorption-spectrum shown in Fig. 2 is then seen.

The band near 9 of scale, or Fraunhofer's line F, encroaches on the upper bright band of the fluorescent spectrum, so that in certain methods of observation, when absorption and fluorescence are observed at once, this bright band seems to be narrower than the one next below, which, however, is not the case in fact.

The band about 13 of the scale, or Fraünhofer's line G, is not well defined, and is connected by a shade with the point about 14, where the absorption becomes total.

The imported chemically pure (?) anthracene, washed

FIG. 5.

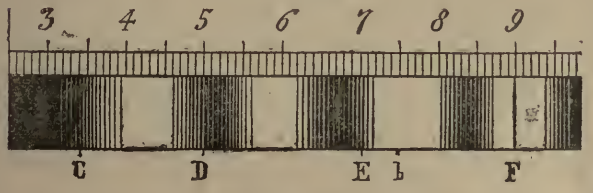
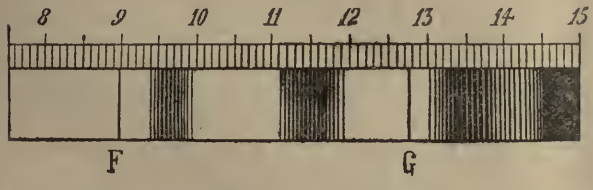


FIG. 6.



with alcohol to remove the above mentioned brown matter answers very well for this observation.

If either of the above two last forms of anthracene are dissolved in benzole (coal-tar naptha) a yellowish solution is obtained, which fluoresces with a brilliant green colour and gives the spectrum shown in Fig. 5, which it will be seen by comparison with Fig. 1 differs from that of the solid substance only in the displacement of all the bands towards the violet end of the spectrum. The same holds good with the absorption-bands, as will be seen by comparing Fig. 6, which shows the absorption spectrum of a solution of impure anthracene (*i.e.*, chrysogen) in Benzole.

This is an action which has never, I believe, been observed before. I have a partial parallel found in a few of the uranium salts which I have examined with this view, but it is not noted by Stokes, Becquerel, or Hagenbach.*

It does not, however, stand alone. Some months since, in a Paper read before the American Institute in New York, and the Franklin Institute Philadelphia (see *Journal of the Franklin Institute* vol. lxiii., p. 296), I announced under the name Viridin a solid substance of remarkable fluorescent properties, and yielding a spectrum closely allied to that of anthracene.

Subsequent experiment has confirmed these results, and has also demonstrated that, like ordinary anthracene, this substance is a mixture of a coloured body yielding a banded spectrum, which, to avoid circumlocution, I would call Thallene, in allusion to the bright green bands of its fluorescent spectrum, as well as to the general character of its fluorescent light; and a white body crystallising in spicules, which I would call Petrollucene, in allusion to its origin, fluorescence, and resemblance to anthracene, from which it differs, however, in crystalline form, melting-point (this being in its case about 700° F.), and in solubility.

With this mixed body, as with the anthracene above described, the spectrum of fluorescence, as also that of absorption, has all its bands displaced towards the more refrangible part of the spectrum, without other change by solution in various solvents.

In the case of the oxalate of uranium the *absorption-bands* are displaced downwards in the spectrum by solution. When a pure spectrum is thrown on a screen covered with either of the above mentioned hydrocarbons or on a tank filled with their solution, a series of maxima and minima of fluorescence are observed which in each case coincide with the absorption-bands of the same body, a maximum of fluorescence coinciding with a maximum of absorption. A relation similar to this was pointed out by Stokes in the case of leaf-green solution, *Phil. Trans.* 1852, Part II., p. 491, and in canary glass and uranium nitrate in a general way, *Phil. Trans.* 1852, Part II., p. 497, and p. 517. Hagenbach has also noticed this relation in a number of the substances which he has examined, and also points out the *absence* of any connection between the numerous absorption-bands seen in nitrate of uranium and the fluorescent maximum of that body.

In conclusion I have to thank my friend Dr. G. F. Barker for valuable aid through his familiarity with the chemical literature of the day, and for aiding me in obtaining a fresh supply of the new material when a difficulty in this direction had arisen; also to Mr. John Truax, of Pittsburgh, in the same connection, also to Mr. J. C. F. Chever, the Superintendent of the works of Messrs. Page, Kidder, and Fletcher, at Bull's Ferry, N.J., for some specimens of unusually fine crude anthracene prepared at those works, from which most of my preparations of that body have been made. Also my assistant, Mr. W. E. Geyer, and Messrs. P. P. Poinier and A. H. G. Sorge, students in the Institute, for various assistance in connection with these observations.

* After the above was written and had been published in the *American Chemist* of September for some weeks I received *Poggendorff's Annalen* in which I find that Hagenbach had just noticed a *similar* action in a few bodies dissolved in different menstrua.

CORRESPONDENCE.

THE UTILITY OF ODOURS TO PLANTS IN RELATION TO RADIANT HEAT.

To the Editor of the Chemical News.

Sir—The more closely and philosophically the works of Nature are studied, the stronger, generally speaking, is the conviction that, in every department of them, a principle of utility has been strictly and uniformly kept in view, and that accordingly, where the enquirer might least expect to discover it, this principle may often be indisputably traced.

A very apposite and striking illustration of this scientific truth is found, I think, in the relation of the odours of flowers, and of other fragrant organs of plants, to radiant heat; and as the subject is one which has not hitherto, I believe, been especially noticed, I may perhaps be permitted to draw attention to it in your valuable pages. In order, however, that these brief remarks may be fully understood, it is necessary to refer to the important and interesting discoveries of Prof. Tyndall, in thermal radiation, a *résumé* of which he delivered before the University of Cambridge, in the Rede Lecture for 1865.

He found then that odours or perfumes, in common with many gases and vapours, especially that of water, have the remarkable property of absorbing large quantities of radiant heat, and particularly the obscure or non-luminous rays, such as those emitted by the earth. Thus he has shown, in his table of the "Absorption of Perfumes," that otto of roses absorbs 37 times as much radiant heat as perfectly dry air, the oil of lavender 60 times as much, that of rosemary 74 times as much, while that of aniseed absorbs no less than 372 times as much.

And, turning from perfumes to vapours, he observes, "that probably from 10 to 15 per cent of the heat radiated by the earth is absorbed within 10 feet of the earth's surface," although the aqueous vapour contained in the atmosphere amounts to only $\frac{1}{2}$ per cent of the whole mass of the air. This aqueous vapour, thus becoming heated, "wraps," as he says, "the earth like a warm garment, and protects it from the deadly chill it would otherwise sustain;" for it must be remembered that radiation and absorption always correspond, and that, accordingly, in the case of gases and vapours, the best absorbers are, at the same time, the best radiators. The same remark applies equally to odours or perfumes; and thus we are brought back to the especial subject of these observations.

Let us, then, consider the case of a tender plant, such as a rose in a healthy growing state, and emitting copiously from its lovely blossoms the unrivalled essential oil to which it owes its fragrance, and let us ask—What is the office which, quite independently of the assumed very subordinate one of regaling the olfactory sense in man, this plentiful and continual discharge of aromatic matter into the atmosphere is intended to fulfil? The answer to this question follows naturally, I think, from the preceding facts; for if, as Prof. Tyndall has proved, the odour of the oil of roses absorbs 37 times more radiant heat than dry air, and radiates in the like degree, we may confidently infer that the plant, in thus generating around it a warm atmosphere of odour, is ministering to its wants by virtually providing for itself a more congenial temperature than it could otherwise enjoy. And if we pass from individual instances, and consider generally that the flowers of plants are especially the seat of the odours they emit,—and, moreover, that the production of seed is essentially dependent upon the flowers, not only physiologically, but in all their physical relations, particularly that of temperature,—we cannot fail, I think, to conclude that the envelopes of aroma, if I may so speak, which surround the flowers must materially aid in the maturation and protection of the seed.

Many fruits also, such as the lemon and orange, so remarkable for their fragrance, may have their ripening hastened by the essential oil that they so freely give forth; this oil, in the case of the lemon, absorbing, according to Prof. Tyndall's experiments, 65 times as much radiant heat as dry air.

Even, too, in the case of some of the flowerless plants, the ferns for example, the odour that the fronds exhale, and which is very characteristic in this numerous and interesting order, may serve as a protection against cold, and thus also indirectly aid the fertilisation of the spores.

It would be easy to present further illustrations of the views which, in a very imperfect form, I have submitted to your readers; but having, I fear, already trespassed upon your columns, I must leave them to follow out the subject in all its instructive and important relations.—I am, &c.,

W. H. Olley.

Stoke Newington.

CONSTITUTION OF MATTER.

To the Editor of the Chemical News.

Sir,—I beg to express my thanks to your correspondent, J. W., for pointing out the inaccuracy of two statements in my paper. Both were clerical errors:—Methyl should have been written $(CH_3)_2$, not CH_3, and "propionic aldehyd" should have been substituted for "propylic alcohol."

But the two particular cases of isomerism that I cited are not necessary to substantiate my illustrations of the oneness of matter; others would do as well, It is evident that Mr. Sutton has confounded matter and force in several instances; but let us proceed to examine his objections to my arguments. He considers the analogous properties of chlorine, bromine, and iodine, and other groups of bodies, to constitute no proof of the mono-elemental theory. If it is not a proof, it is at least an argument in its favour; and if I can show that the atomic theory supports the mono-elemental one, it will be almost a proof under Mr. Sutton's view of matter, for he says the atomic theory is opposed to unity of matter. Now Mr. S.'s view is embraced in the following passsge:—"We have no doubt that the only difference between the so-called elements (hydrogen, oxygen, &c.) is the difference of their respective atomic weights, and *of course* corresponding atomic sizes;" but nickel and cobalt have the same atomic weights and sizes,—therefore there is *no* difference between the two, so that nickel is cobalt and cobalt is nickel, and yet Mr. Sutton argues that in their natures they are different. It really seems as though he were ignorant of the existence of groups which, regarded under his favourite theory, viz., the atomic theory, are isometric,—that is, have the same atomic weights and sizes or volumes.

Mr. Sutton next writes—"And if this is the case, the ultimate atoms themselves (whether of hydrogen, oxygen, or any other element) must be all of the same and only elemental matter, because, not being themselves composed of atoms, no difference in the nature of their substance can exist." The meaning of this is apparently "buried" in "profound obscurity;"—if atoms are not composed of atoms, what are they composed of?

I confess I fail to see into what error Mr. Sutton affirms I have fallen, but it is obvious that he has made a serious error by saying "the withdrawal of the forces cannot alter the atomic sizes." If this be a fact it is most important, but I am unwilling to accept it as such until I know by what experiments or reasoning he has demonstrated it. Would it not be wiser to say the atomic size is an effect of force? For if it is not, then the atomic volume of water at 100° C. would be the same as at 0° C.—yet even Mr. Sutton would see the untruth of this. Again, if "the withdrawal of the forces cannot alter the atomic sizes," why should the atomic volume of any one

element or body be different from that of any other? Or (to view the matter in another light) if matter cannot exist without force, then force must exert an influence over matter under any circumstances,—therefore the size or volume of atoms is influenced by force.

Your correspondent is apparently delighted to find a lack of faith on my part in what he is pleased to call "my philosophy," which includes the belief that a "compound is formed by a uniting force between two or more such differently operated upon portions of elemental matter," because I confess that in potassic iodide the iodine exists in its own nature. Does not Mr. Sutton see that the whole gist of my paper was to prove that iodine in its nature is the same as hydrogen, or any other so-called element, the different properties arising from each of the different portions of elemental matter being influenced by the forces in peculiar ways? and, if so, where has he discovered my lack of faith? The fact is that he based all his arguments upon atomic volumes and weights, which subject in his hands, as opposed to the mono-elemental theory, entirely broke down, and, as a necessary consequence, the arguments founded upon it.—I am, &c.,

Chas. T. Kingzett.

Liverpool, October 16, 1872.

ITALIAN CHEMICAL MANUALS.

To the Editor of the Chemical News.

Sir,—The statement recently circulated as to the non-existence of chemical manuals in the Italian language is incorrect, as the following list of such works amply proves.—I am, &c.,

A. H. C.

Piria, R., "Lezioni Elementari di Chimica Organica." Turin, 1870.
Tassinari, P., "Avviamento allo Studio della Chimica." Pisa and Turin.
Tassinari, P., "Manuale di Chimica Inorganica." Pisa.
Orosi, "Manuale di Chimica Analitica Inorganica." 1871.
Scivoleto, P., "Principi di Chimica Analitica." Naples, 1869.
Selmi, A., "Chimica applicata all' Agricoltura." Milan, 1871.
Mancuso, G., "Trattato di Chimica Generale e Descrittiva." Palermo, 1872.
Antonelli, "Trattato di Chimica Moderne." Modena, 1865.
Bouzani, F., "Elementi di Chimica Inorganica." Savona.
Church, A. H., "Guida al Laboratorio." Venice, 1872.
Carlevaris, P., "Trattato di Chimica." Turin, 1870.
Selmi, F.. "Manuale di Chimica Inorganica." Turin.
Tessari, N., "Compendio di Chimica Generale." Rovereto.

MODIFICATION OF MOHR'S BURETTE.

To the Editor of the Chemical News.

Sir,—I observe in your last issue a paper on "A Simple Modification of Mohr's Burette, to adapt it to all Test-Liquids," as suggested by Capt. Heriot and Mr. R. Biggs.

Allow me to refer those gentlemen to a communication made by me to the Bristol Naturalists' Association, in February, 1864, and reported in the Chemical News, vol. ix., p. 94, in which I described and exhibited an instrument precisely similar to theirs, and claimed for it the obvious advantages mentioned in the more recent paper.

I have had the instrument I then exhibited in frequent use since, but have recently discarded that and all other forms of burette in favour of the glass stop-cock modification, which is now made to perfection, is but slightly more expensive than the other sorts, and leaves nothing to be desired for ease and precision in manipulation.—I am, &c.,

Edward Collens.

Birmingham Vinegar Brewery,
October 23, 1872.

[In reference to this form of burette, another correspondent says that a similar one was used in Mr. Vernon Harcourt's and Mr. Esson's elaborate investigation into the laws of the rate of chemical change, at the Oxford University Laboratory. He calls our attention to one or two serious defects of the arrangement, which have more than once tempted him to abandon it for the glass stop-cock:—(1). Any change of temperature either expands the air above the fluid, and causes loss or excessive delivery, or else causes contraction, and rise of air into the beak, with consequent raising of the level of the liquid in the burette. In the latter case any attempt at adjustment is almost always accompanied with loss of fluid. (2). It is next to impossible to deliver single drops by the arrangement, unless the beak is so contracted as to give nothing else,—a state of things obviously inconvenient. (3). Leakage is always occurring at the cork, so that air is admitted above, under the strong pressure of the long column of fluid contained by the burette when full.—*Ed. C. N.*]

MISCELLANEOUS.

Salles du Progrès, Soirées et Matinées de Science Illustrée.—The Abbé Moigno has forwarded to us the comprehensive programme of a plan devised by him, the arrangements for which are now completed, to give popular instruction, varied by recreative musical and physico-chemical, optical, and other experiments and exhibitions, for the purpose, in the first place, of aiding the education of a large class of people in Paris who now spend too much of their time in frequenting cafés, chantants, and other places of amusement of a questionable character; and also of affording instruction to young men in science in its widest sense, inclusive of art and applied science. The Abbé Moigno considers that ignorance is at the bottom of the many evils and dangers of his country; and in order to instruct and elevate the mind, he has spared no pains or expense to render his Salles du Progrès attractive as well as useful, by judiciously combining the *utile dulci*. We sincerely wish him success, and trust that the institution may prove a real boon to that country of which we hope will be verified in more than one sense the *fluctuat nec mergitur* of the Parisian coat of arms, because—La France intelligente éclairée et libérale ne périt pas.

Quality of the Gas of London.—Dr. Letheby, the Chief Gas Examiner appointed by the Board of Trade, has recently reported to the Corporation of London, and the Metropolitan Board of Works, on the quality of the gas supplied by certain of the Gas Companies during the quarter which has just expired; from which it appears that the average illuminating power of the Chartered Gas has been as follows:—17·39 standard sperm candles at Beckton; 17·01 at Cannon Street; 17·45 at Friendly Place, Mile End; 17·96 at Arundel Street; and at Millbank 17·35. That of the Imperial Company has been, 17·46 candles at Oakley Square, Chelsea; 15·85 at Camden Street, Camden Road; and 16·59 at Graham Road, Dalston; while that of the South Metropolitan Gas Company at Hill Street, Peckham, has been 15·71 candles. The average illuminating power of the cannel gas supplied by the Chartered Company has been equal to 25·12 standard sperm candles at Arundel Street, Haymarket; and 27·10 candles at Millbank. With regard to purity, Dr. Letheby reports that the gas at all the testing places has been, except on two occasions, constantly free from sulphuretted hydrogen. The two occasions referred to were the 3rd of August and the 26th of September, when the gas of the South Metropolitan Company at Hill Street, Peck-

ham, contained traces of this impurity, which he ascertained were due to unavoidable circumstances. The amounts of sulphur in other forms than this have averaged in the case of the Chartered Company's common gas, 11·19 grs. per 100 cubic feet at Beckton; 10·50 grs. at Cannon Street; 6·36 grs. at Friendly Place; 9·94 grs. at Arundel Street; and 23·37 grs. at Millbank. In that of the Imperial Company it has averaged 32·64 grs. at Oakley Square; 26·74 grs. at Camden Street; and 27·68 grs. at Graham Road. The amount of sulphur in the South Metropolitan gas has averaged as much as 33·4 grs. per 100 cubic feet. The average amount of this impurity in the cannel gas of the Chartered Company has been 15 grs. at Millbank, and 25·36 grs. at Arundel Street. It appears that, with one day's exception, the proportion of sulphur in the common gas of the Chartered Company at four of the testing places—viz., at Beckton; at Friendly Place, Mile End; at Cannon Street; and at Arundel Street—has not exceeded 20 grs. per 100 cubic feet during the whole quarter; and for the last two months it has not exceeded 15 grs. per 100 feet. This is very satisfactory, for it shows that with the care used at these works the proportion of sulphur can be kept under 20 grs. per 100 feet. The quantity of ammonia in the gas of all the Companies has been at all times below the prescribed amount of 2·5 grs. per 100 cubic feet. Dr. Letheby has drawn the attention of the Corporation and the Metropolitan Board of Works to certain irregularities in the returns of their Gas Examiners, and has pointed out the necessity of fulfilling the obligations of the several Acts of Parliament, which are in the interests of the public.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, October 14, 1872.

This number opens with a lengthy report by M. Tresca of the proceedings of the International Congress for Weights and Measures. The labours of the Congress are concluded.

New Process of Estimating Free Oxygen.—Schützenberger and Gérardin.—Hydrosulphite of soda, S_2O_2NaOHO, or, according to the new notation, SNaOHO, differs from bisulphite of soda only by 2 equivalents or 1 atom of oxygen; in the presence of free oxygen, that gas is at once absorbed by the hydrosulphite, and instantaneously converted into bisulphite, $S_2O_2NaOHO+O_2=S_2O_4NaOHO$, or—

$$SNaOHO+O=SONaOHO.$$

The solution of the hydrosulphite of soda is readily obtained by causing zinc scraps to act upon a solution of bisulphite of soda (sp. gr. at 15°, 1·162) in a closed bottle for some twenty to twenty-five minutes; this solution is used to absorb oxygen gas, and has the advantage of not soiling the test-tubes like pyrogallate of potassa. The solution is also applied by the authors to test the presence and estimate the quantity of free oxygen dissolved in water, which is first tinged with Coupier's soluble aniline blue, a compound which is instantly decolorised by the hydrosulphite of soda, but is not acted upon by the bisulphite of that alkali; the solution of hydrosulphite is then added until decoloration takes place. As this reagent is prone to decomposition, it is titrated. The authors having found that the hydrosulphite decolorises a solution of ammoniacal sulphate of copper, while the sulphite and bisulphite of soda do not act upon it so long as ammonia is in excess, a strongly ammoniacal solution of that salt is so made that 10 c.c. of the fluid contain a quantity of copper corresponding, as regards the action of the hydrosulphite, to 1 c.c. of oxygen. The operation is conducted as follows:—A bottle of a capacity of from 60 to 100 grms. is partly filled with water, and a spiral of sheet-zinc and some lumps of granulated zinc are added; 10 c.c. of the solution of bisulphite of soda are then added, and the bottle next filled with water, and closed with a caoutchouc stopper. After having been shaken for a few moments, the vessel is allowed to stand for twenty minutes, and the reagent is ready. On the other hand, 20 c.c. of the copper solution (ammoniacal sulphate) are poured into a test-glass, and some oil is poured on the surface. A litre of the water to be tested is poured into a large-sized beaker-glass, and coloured by means of a few drops of Coupier's aniline blue, and some oil is also poured on its surface. With a graduated pipette, from 50 to 60 c.c. of the hydrosulphite solution are taken and poured gradually into the copper solution, taking care to stir it with a glass rod until decoloration takes place; next, with the same pipette, the hydrosulphite solution is poured gradually into the water also until decoloration takes place, care being taken in each case to hold the point. Supposing 17·5 c.c. of the hydrosulphite to have been used to decolorise the 20 c c. of ammoniacal sulphate of copper, the quantity thereof corresponding to 2 c.c. of oxygen, and that, on the other hand, the litre of water has required 36·4 c.c. of the hydrosulphite solution, we put the following equation:—

$$17{\cdot}5 : 2 = 36{\cdot}4 : x = \frac{36{\cdot}4 \times 2}{17{\cdot}5} = 4{\cdot}16 \text{ c.c. of oxygen dissolved in the water.}$$

Anti-Ferment Substances.—A. Petit.—This paper contains the record of some experiments made with the view to ascertain the effect of certain substances on a fermenting liquid made up of 50 grms. of sugar to the litre, and 0·5 grm. of dry yeast to 10 c.c. of fluid. It appears that when silicate of soda and borax are added to such a solution, these salts exert no marked anti-fermentative action. 1 per cent of a solution of sulphate of iron does not affect the fermentation; but it is arrested by a 1 per cent solution of sulphate of copper. Phosphorus, oil of turpentine, mustard-powder, creosote, sulphuric and tartaric acids, all in quantities of 1 per cent, fail to affect fermentation; while 1-100th of arsenious acid renders the action more slow, 1-300th of oxalic acid renders it still slower. Acetic acid does not appear to be an anti-ferment, and a liquid containing 25 per cent of alcohol, 5 per cent of glycerine, and 1 per cent of succinic acid, enters readily into fermentation; on the other hand, corrosive sublimate and red oxide of mercury are strong anti-ferments, even in very small quantities. Sulphites do not impede fermentation, and are converted into sulphates.

Sitzungsberichte der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften zu München, No. 2 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Quantity of Ammonia Contained in Snow-Water.—Dr. Vogel.—This essay contains in the first place an excellent *resumé* of the labours of different *savants* on the presence of ammonia in the atmosphere and in arable soil, as well as in rain- and snow-water. The author refers to Dr. von Liebig's researches, made in 1826 and 1827, on the quantity of ammonia as nitrate in rain-water, and then records at length his own researches on the presence and quantity of ammonia contained in snow and in snow-water. The method employed by him in this instance is that of Schlösing, somewhat modified, as applied to the estimation of ammonia in arable soil; the following results were obtained, 1 litre of the snow-water being the unit:—Freshly-fallen snow, collected in a porcelain basin, at 0° gave 0·003 grm.; at −3° gave 0·002; at from −9° to −15° gave 0. Snow-water, from snow which had lain for twenty-fours on a piece of garden-ground manured during the previous autumn, contained 0·012 grm. Snow-water from snow which had been laying for twenty-four hours on a meadow contained 0·009. Snow (all of the same period of falling) which had been deposited for twenty-four hours on a zinc-covered roof contained 0·004. The author observes that the quantity of ammonia contained in snow depends upon a variety of conditions, and that since snow, owing to its porosity, absorbs ammonia, and the same obtains with the water formed from it, it is absolutely necessary to melt it in closed vessels. It appears that the quantity of ammonia contained in snow is also affected by the temperature at which it falls; at rather low temperatures (−15°, December, 1871) the author could not detect ammonia in such snow by Nessler's reagent for ammonia.

Photographic Effect (Licht Wirkung) of Variously Coloured Leaves.—Dr. Vogel.—Notwithstanding the high scientific value of this memoir, its contents are not suited for abstraction.

Observations on Minerals Occluded in Volcanic Rocks.—F. Sandberger.

Although not strictly belonging to chemistry, we quote the title of the following exhaustive memoir:—

Researches on Phyto-Electricity.—Dr. J. Ranke.

Preliminary Observations on Buchonite, a Kind of Rock Belonging to the Group of Nephelines.—F. Sandberger.—This memoir contains the exhaustive geognostico-mineralogical description of a new mineral discovered by the author in the Rhœn mountains, Bavaria, and called by him Buchonite (from Buchonia, apparently the ancient Latin name for the Rhœn district). The chemical composition of this mineral is, in 100 parts—Silica, 51·42; alumina, 15·39; protoxide of iron, 21·04; magnesia, 3·68; lime, 4·09; potassa, 1·07; soda, 2·37; water, 0·55; total, 99·61. A more complete analysis, including the undetermined small quantities of chlorine, phosphoric acid, titanic acid, and peroxide of iron, will be shortly published.

Spontaneous Decomposition of an Alloy of Lead.—Dr. Vogel.—It appears that among the collection of coins and medals belonging to the University of München there are preserved some copies of medals and coins made of a soft alloy—bismuth and lead—which was found to consist (when unaltered) of various proportions of the metals alluded to, viz.—(1). Lead, 66; bismuth, 34. (2). Lead, 86; bismuth, 14. (3). Lead, 88; bismuth, 12. It is apparent that these alloys were not

all made at the same time; in some instances the medals cast in these alloys had not only become somewhat oxidised but even quite fallen to powder, which effervesced on being treated with acetic acid, and the solution was found to contain chiefly lead, but bismuth was also present. The author observes that it is rather curious that alloys kept in well-closed show-cases should have become thus altered and deteriorated; the cause is ascribed to the tendency of bismuth to crystallise, whereby a molecular change is first effected, and thus oxidation is rendered more easy.

Les Mondes, October 17, 1872.

Inauguration of the Salle du Progrès.—Mazas de Sarrion.—The opening meeting of this institution was held on the 15th inst.; among the distinguished *savants* present we notice the following:—Dr. Otto Struve, director of the Imperial Russian observatory on the Pulkova, and President of the International Congress for Weights and Measures held at Paris; M. Broch, formerly Minister of Marine for Norway, and also a member of the Congress just-mentioned; the eminent botanist, M. Gay; and Professor Chasles. The author speaks in high terms of the excellent plan of instruction adopted by the Rev. Abbé Moigno, and states that great satisfaction was felt by all present at the *tout ensemble* of the proceedings.

Disinfection and Collection of Fœcal Matters; Fahlman's System.—L. Créteur.—The description of a mechanical contrivance applied to a closet, by the arrangement of which the fœtid gases are destroyed, the fœcal matter collected, and a rich manure produced; but nothing is said relating to the chemical and disinfecting methods applied.

Aurora Borealis, Thunderstorms, and Waterspouts.—Rev. Laborde.—This lengthy paper contains the author's views on these phenomena, which are explained by viewing our globe as a large-sized Leyden jar.

Journal de Pharmacie et de Chimie, October, 1872.

This number contains the following original papers relating to chemistry:—

Researches on the Gases Contained in the Blood.—Mathieu and Urbain.—By means of a series of experiments, conducted with peculiarly-constructed apparatus, the authors have made a chemical analysis of the gases contained in the blood taken from living animals kept at normal conditions of diet and mode of living. It appears that the proportion of gas contained in the arterial blood of an animal is the same when that animal is in the same condition; it further appears that the quantity of gases contained in the smaller arteries is less, in consequence of the smaller quantity of blood globules present in these vessels. As regards the respiratory action, the authors are inclined to think that endosmose and diffusion of gases play a very important part in that action.

Animal Charcoal and Phosphate of Lime.—M. Collas.—The author first observes that there is, as far at least as decoloration is concerned, no necessity whatever to wash animal charcoal with dilute hydrochloric acid for the purpose of increasing thereby its decolorising property; he next observes that the hydrated phosphate of lime, the gelatinous precipitate caused by ammonia in an acid solution of bone-ash, has a powerful affinity for colouring matters, organic as well as inorganic, and that that substance by itself exerts a decolorising effect upon raw sugar. The conclusions drawn from these observations are that, far from being injurious, the phosphate of lime present in bone-black is really a useful ingredient, both on account of increasing the efficacy of the charcoal by rendering it more porous, and by acting as a decoloriser itself; bone-black should be washed with pure water before being used, and should be stored in cellars so as not to be exposed to direct sunlight.

Note on Testing Essential Oils for Adulteration with Alcohol.—M. Gault.—The essential oils, which are similar as regards their composition to the hydrocarbons ($C_{10}H_{16}$), are with difficulty dissolved in alcohol at 86 per cent applied in the proportion of 1 to 5. The essential oils containing oxygen, the composition of which is akin to aldehydes, and also such as contain sulphur, are more or less rapidly dissolved in alcohol of the same strength and applied in the same proportion; the mixture of these essential oils yields, even in the proportion of 1 to 10, a precipitate. If it is desired to make alcoholic solutions of essential oils—so-called essences—then the quantity of alcohol to be employed may be proportional to the degree of oxidation, the age, and the exposure to light and air of such oil.

Cultivation of the Cinchona Trees in Java.—M. van Gorkom.—In a letter to M. L. Soubeiran; the author states that the cultivation of these trees prospers in every respect; a manufactory has been established for the preparation on the spot of alkaloids, extracts, and other pharmaceutical preparations derived from the cinchona barks, and 6 tons of that bark were sold by public auction at Amsterdam in March last. The annual expenses of the cultivation, &c., are now balanced, and all the original outlay of capital is expected to be returned before the year 1876.

Neues Jahrbuch für Pharmacie und Verwandte Fächer, von Dr. F. Vorwerk, July, 1872.

In addition to original papers strictly belonging to pharmacy and pharmacognosy, this number contains the following original paper relating to chemistry:—

Metals Contained in Soot from Coals.—H. Reinsch.—The author states that, while testing some soot collected in a stove-pipe, he perceived the smell of arsenic; this gave rise to further experiments, the result of which showed that the soot contained iron, manganese, copper, arsenic, potassa, soda, and lime, in rather considerable quantities. The coal which yielded this soot is that found at Zwickau, Saxony.

August, 1872.

This number contains no original papers relating to chemistry.

La Revue Scientifique de la France et de l'Etranger, September 28, 1872.

In addition to several original papers strictly belonging to physiology, topography, and medicine, this number (retarded in transmission) contains a report of the proceedings of the Chemical Section of the late meeting of the French Association at Bordeaux, from which we abstract the following:—

Chloride of Silver.—M. Stas.—When recently precipitated, this substance is soluble in water, 1 litre dissolving 13 m.grms. at the ordinary temperature, and 25 m.grms. at boiling temperature. These solutions are precipitated by hydrochloric acid, as well as by nitrate of silver; 1 molecule of the chloride of silver requires, for complete precipitation, 3 molecules of either the acid or the salt. Bromide of silver is completely insoluble in cold water, and only slightly soluble (2 m.grms. to the litre) in boiling water. When chloride of silver is dissolved in acetate of mercury, it requires for precipitation a quantity of hydrochloric acid or of nitrate of silver in the proportion of 3 : 1.

Analysis of Phosphates.—M. Prat.—The native phosphate is first acted upon by bisulphate of ammonia at a high temperature, and is next treated with cold water; carbonate of ammonia is then added to the decanted solution, whereby lime and alumina are precipitated quite free from phosphoric acid, which is left in the solution and estimated as metaphosphoric acid.

Ozone.—Liès-Bodart.—Experiments made by the author prove that, while albumen is not acted upon by ozone—retaining even the property of coagulating by heat—blood albumen, which in consequence of its colouring matter cannot be used in calico-printing, becomes quite decolorised by the action of ozone, leaving white and perfectly coagulable albumen. It further appears that ozone is a very powerful disinfectant, since the author found that a room, in which sulphydrate of ammonium was purposely spilt, was readily disinfected by ozone.

Fulminating Compound.—M. Prat.—As a substitute for the fulminate of mercury in percussion caps, the author has used a mixture consisting of picrate of lead, chlorate of potassa, and a very small quantity of amorphous phosphorus.

Hydrofluoric Acid.—M. Prat.—By causing phosphoric anhydride to act upon anhydrous hydrofluoric acid, the author obtained water and a non-condensable gaseous hydrofluoric acid, thus rendering it probable that the substance hitherto viewed as hydrofluoric acid contains oxygen; the non-condensable hydrofluoric acid just alluded to yields, by saturation with oxide of silver, a fluoride of silver resembling the chloride and quite different from the ordinary fluoride of silver. From these researches it would follow that the bodies known as fluorides, fluor-spar for instance, is, instead of fluoride of calcium, an oxyfluoride, and that the atomic weight of fluorine is wrong.

Abnormal Density of Perchloride of Phosphorus.—M. Wurtz.—The abnormal density (sp. gr.) of this body is stated to be due to its dissociation into free chlorine and protochloride of phosphorus. The author has made a series of careful experiments with the view of avoiding the dissociation and estimating the density of the perchloride, by operating in an atmosphere of the protochloride; while the theoretical density of the perchoride of phosphorus is 7·219, the author has found the following cyphers:—7·069, 7·687, 7·317, 6·255, 7·061, 6·975, 8·203, 6·806, 7·143, 6·785, 6·656. The figures most differing from the theoretical density have been found under special conditions, and depend upon the *rapport* of the volumes of the vapours of perchloride and protochloride of phosphorus; the very high figures belong to experiments in which the bulk of perchloride was very small, while in the case of the low figures the volume of the perchloride was in excess of that of the protochloride.

October 19, 1872.

This number does not contain any original papers relating to chemistry, but we call attention to—

Bibliography.—"Leçons Elémentaires de Chimie Appliquée aux Arts Industriels," par M. J. Girardin, Correspondant de l'Institut; cinquième édition, entièrement refondue, avec figures dans le texte. Vol. II. Chimie minérale: métaux. Paris: Hachette. This is one of the best popular works on chemistry ever published, and contains very valuable short biographical notices of *savants*, chemists, manufacturers, and others, whose labours are quoted or referred to in this book.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2630. J. W. Pollard, Mincing Lane, J. Schofield, Mark Lane, and A. Butel, Bow, Middlesex, "Improvements in the treatment of spent oxides of iron for the purpose of extracting cyanides."—Petition recorded September 4, 1872.

2648. A. C. Duncan and A. Duncan, Manchester, "Improvements in the production of Turkey red."—Petition recorded September 6, 1872.

2845. F. Walton, Staines, Middlesex, "Improvements in oxidising oil, and in machinery to be employed for that purpose."

2847. C. W. Harrison and A. H. Harrison, High Holborn, "Improvements in combining atmospheric air and certain gases for lighting and heating purposes."—Petitions recorded September 26, 1872.

2855. J. McKelvie, Edinburgh, N.B., "Improvements in the manufacture for illuminating gas."—Petition recorded September 27, 1872.

2861. C. W. Siemens, Westminster, "Improvements in the process for the production of iron and steel, and in furnaces or apparatus employed for that purpose."—Petition recorded September 28, 1872.

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

2950. T. Greener, Darlington, Durham, and W. Ellis, Gateshead, Durham, "Improvements in the manufacture of iron and in the production of "fetling" for improving the quality and yield of iron in the process of reduction."—Petition recorded October 7, 1872.

NOTICES TO PROCEED.

1604. R. Ironie, Leith, N.B., and J. Mackintosh, Buenos Ayres, Argentine, "Improvements in the manufacture of paper stock."—Petition recorded May, 27, 1872.

1616. J. H. Dennis, Liverpool, "Improvements in the treatment of copper precipitate, and in the utilisation of impurities contained therein."—Petition recorded May 28, 1872.

1649. M. Donbelt, Berners Street, Middlesex, "Improvements in the preparation of iron for purposes where great tensile strength is necessary."—A communication from L. Lwoff, St. Petersburg, Russia.—Petition recorded May 31, 1872.

1690. W. Riddell, Bishopsgate Street, London, "Improvements in the manufacture of paper pulp from vegetable fibres, and in apparatus therefor, which apparatus is also designed to be employed in making chloride of lime for bleaching pulp, and in other similar processes."—Petition recorded June 4, 1872.

1739. F. G. Morton, Bermondsey, Surrey, "An improvement in utilising tin-plate scraps or clippings, and in separating the tin and iron contained therein."—Petition recorded June 8, 1872.

1770. J. Birch, Newton Heath, Lancashire, "Improvements in the manufacture of iron and steel, and in apparatus to be used in such manufacture."—Petition recorded June 12, 1872.

1876. S. B. Smith, Birmingham, and J. W. Willans, Middlesbrough, "Improvements in the process of, and apparatus for, smelting iron ores and other ores, and re-heating iron and other metals, parts of which improvements may also be applied to other purposes."—Petition recorded June 21, 1872.

2318. J. Henderson, New York, U.S.A., "Improvements in converting cast-iron into steel and wrought-iron, and purifying cast-iron for foundry and other purposes."—Petition recorded August 3, 1872.

2358. T. Warren, Glasgow, N.B., "Improvements in, and connected with, furnaces employed in the manufacture of glass."—Petition recorded August 8, 1872.

2450. F. Lipscombe, Strand, Middlesex, "Improvements in the treatment of noxious vapours, and in apparatus or appliances in connection therewith."—Petition recorded August 16, 1872.

2518. W. Lochhead, Glasgow, N.B., "Improvements in treating asbestos or amianthus, and applying the same to various useful purposes."—Petition recorded August 24, 1872.

2692. F. A. Gatty, Accrington, Lancashire, "Improvements in producing certain colours on cotton fabrics and yarns."—Petition recorded September 11, 1872.

2766. W. E. Newton, Chancery Lane, Middlesex, "Improvements in the preparation of explosive compounds."—A communication from J. H. Norrbin and J. Ohlsson, Stockholm, Sweden.—Petition recorded September 18, 1872.

2786. P. P. F. Micheá, Jubbulpore, East India, "New substances for dyeing, printing, and tanning, and the process employed for treating one of such substances."

2787. P. P. F. Micheá, Jubbulpore, East India, "New substances for dyeing, printing, and tanning; also applicable for the manufacture of paper, and threads or yarns."—Petitions recorded September 20, 1872.

2827. C. J. A. Dick, Pittsburgh, Penn., U.S.A., and G. A. Dick, London, "Improvements in the manufacture of wires, applicable to telegraphic purposes."—Petition recorded September 25, 1872.

PATENTS SEALED.

1054. E. Sonstadt, Ramsey, Isle of Man, "Improvements in the manufacture of iodide of potassium and of bromide of potassium."—Dated April 10, 1872.

1243. S. W. Rich, Chenies Street, Middlesex, "Improvements in the manufacture of sulphates."—Dated April 25, 1872.

2035. B. Todd, Newcastle-upon-Tyne, "Improvements in the treatment of gases and fumes."—Dated July 5, 1872.

2389. H. A. Bonneville, Rue de la Chaussée d'Antin, Paris, "A new or improved process of manufacturing cast-steel."—A communication from H. A. Levallois, Rue de Chalrol, Paris.—Dated August 10, 1872.

2417. F. D. Blyth, Fenchurch Street, London, and A. G. Southby, New Inn, Strand, Middlesex, "Improvements in the process and apparatus for treating wood for the manufacture of pulp for paper."—Dated August 14, 1872.

2431. T. Routledge, Ford Works, near Sunderland, "Improvements in treating fibrous substances for textile purposes, and for the manufacture of paper stock."

2443. W. R. Lake, Southampton Buildings, London, "Improvements in puddling furnaces."—A communication from G. E. Harding, New York, U.S.A.—Dated August 15, 1872.

FOREIGN PATENTS.

AUSTRIA.

291. A. Brunner, "Improvements in the construction of blast-furnaces for iron.—Dated May 29, 1872.

295. F. Fischer, "Manufacturing paper for cigarettes."—Dated May 16, 1872.

304. J. Hiebl, "A mechanical and chemical process for obtaining white paper pulp of all sorts of wood."—Dated May 25, 1872.

325. K. Moser, "Reverberatory furnaces for roasting iron ores by means of the gas of blast-furnaces or other gases."—Dated May 26, 1872.

372. M. J. Elsinger and Son, "Waterproofing and improving tissues."—Dated June 28, 1872.

374. D. A. Fyfe, "Improvements in preparing paper materials, and in bleaching other substances."—Dated June 20, 1872.

379. J. Henderson, "Improvements in the manufacture of steel-iron, wrought- and cast-iron, from pig-iron."—Dated June 22, 1872.

404.—G. Rütgers, "Impregnating timber."

405. G. Rütgers, "An improved method of impregnating timber with a solution of mercurial sublimate."—Dated June 1, 1872.

409. W. C. Tenchert, "A galvanic battery with salts of great solubility and an increased current."—Dated June 8, 1872.

BELGIUM.

31094. C. Vanden Hoff, "Preserving game in cases."—Dated August 26, 1872.

31111. L. G. G. Daudenart and E. Verbert, "Treating yolk and other suds by means of barytes, &c."

31112. L. G. G. Daudenart and E. Verbert, "Manufacturing baryta salts."—Dated August 29, 1872.

31116. C. Morfit, "Improvements in the manufacture of pure phosphates of lime."

31118. J. Buzino, "A tooth-powder."—Dated August 30, 1872.

31120. F. G. Prange and W. Whitthread, "Improvements in utilising sewage."

31123. C. Morfit, "Improvements in the chemical treatment of phosphates, minerals, &c."—Dated August 31, 1872.

31127 C. Morfit, "An artificial product for superseding guano."

31131. M. F. R. Faure and J. L. Kessler, ""Improvements in concentrating and evaporating sulphuric acid."—Dated September 2, 1872.

31132. A. Grandvallet and F. Kienast, "An apparatus for warming railway-carriages, and chemical coal employed therefor."—Dated September 3, 1872.

31142. C. M. T. du Motay, "Improvements in the construction and use of blast-furnaces."

31144. D. Putzeys and Bouvrie, "Improvements in the manufacture of glass."—Dated September 5, 1872.

31 146. E. Marton and L. Havet, "Food called mealy cream."

31151. A. J. Martelette, "A composition for removing incrustation in steam boilers."—Dated September 6, 1872.

31589. C. Prouvost, "A mixed dye for obtaining several tints by a single immersion."—Dated September 7, 1872.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 675.

NOTE ON THE ANALYSIS OF SOAPS.

By F. JEAN.

Although there are still soap-boilers who make *bona fide* soaps, containing no less than 54 per cent of fatty acids, and not more than from 35 to 40 per cent of water, the desire to produce low-priced soaps has led to the introduction of various substances which can only be considered as fraudulent adulterations. Resin (colophonium) is one of the most common of these substances. It is known that resin, when combined with potassa or soda, forms a resinate which, when mixed with water, yields an abundant lather, and this substance is now generally used in the manufacture of soaps. In some countries, however, it is only used in soft soaps. It certainly renders soaps more suitable for use with hard, or even sea, water, but its use is decidedly injurious for some of the applications of soap; for instance, when resin soap is used in the fulling of woollen cloth, it produces peculiar greasy spots, and woollen materials washed with soaps containing resin are difficultly mordanted, and not uniformly dyed. Unfortunately we possess no process by which resin can be accurately separated from the fatty acids. The oldest process of separation—that of Sutherland—consists in boiling the mixture of fatty acids and resin with concentrated nitric acid until the evolution of nitrous acid gas ceases: the resin, thus converted into terebic acid, which is soluble in water, is easily separated from the fatty acids, and these, according to Sutherland, are scarcely acted upon by the nitric acid; but in reality the reaction is not so simple, for, in addition to terebic acid, there is formed azomaric acid, which, being insoluble, remains mixed with the fatty acids, and the latter are, moreover, acted upon to some extent by the nitric acid, the result being that products soluble in water are formed;* the oleic acid is not simply converted into its isomeric elaidic acid, and it is therefore evident that this process does not give reliable results.

Gottlieb's process, as described by Bolley, is altogether useless; the sulphate of magnesia precipitates the bulk of the resinate along with the magnesia soap, and hardly a trace of resin is separated. Rampal's process, described in his memoir on Savonimetry, published as a prize essay by the Société Industrielle de Mulhouse, does not quite answer the purpose. According to this author, the separation of mixed fatty acids and resin is effected by dissolving the same in from 5 to 10 parts of boiling alcohol, and the addition to that liquid of an equal bulk of boiling water; the fatty acids float on the top of this liquid, while the resin is precipitated in the shape of a finely divided powder: it is true that the resin is separated, but in the first place it requires a far larger quantity of water, and some of the fatty acids are precipitated with the resin. If boiling water is added to a boiling alcoholic solution of pure fatty acids, the liquid becomes milky, and remains so for several days: it is thus evident that Rampal's process is not satisfactory.

Cailletet's process admits of qualitatively detecting resin in soap, in the following manner:—10 c.c. of the aqueous solution of the soap to be examined are poured into a narrow test-tube, and dilute sulphuric acid in slight excess is added; the fatty acids thus separated are then dissolved by the addition of some 2 or 3 c.c. of oil of turpentine, while the resin remains in the liquid as a flocculent substance.

Finding that the processes described in works on analytical chemistry for the separation of resin from fatty acids are not reliable, I considered that a more elaborate examination of the properties of the resinates might lead to the discovery of a more practical process for the separation and estimation of the resin in soap. I first tried to saponify the resin, by boiling it with caustic soda lye; but since the resin floats on the top of the boiling liquid saponification in this way becomes a slow affair: in practice on the large scale the resin becomes mixed with semi-saponified fatty matter, and then the resin itself is readily acted upon. By operating, however, in a small Papinian boiler, at a pressure of 3 atmospheres (75 lbs. to the square inch), the saponification proceeds rapidly. With 100 grms. of resin and 200 c.c. of caustic soda lye, at 15° Baumé = 1·116 sp. gr. = about 8 per cent of dry caustic soda, I obtained complete saponification in half an hour. The saponified material consists of an insoluble portion, A, and of a soluble portion, B; 100 grms. of resin gave 135 grms. of the resinate A and 75 c.c. of the resinate B.

Investigation of the Resinate A.—The resinate A, separated from the soluble resinate B by washing with a caustic soda solution at 5° Baumé, resembles dark-coloured soft soap, of a somewhat gelatinous consistency; its colour is bright brown; the substance is not very soluble in cold water, but it is soluble in boiling water, alcohol, and oil of turpentine. On being analysed I found it contained 54 per cent of yellowish-brown-coloured resin, 3·1 per cent of soda, and 49·2 per cent of water. The aqueous solution of the resinate A, previously freed from excess of alkali, exhibits the following reactions:—the chlorides of sodium and barium, bicarbonate of soda, acetate of lead, sulphate of magnesia, sulphate of soda, chloride of potassium, and ferrocyanide of potassium, form precipitates; caustic soda solution also precipitates the resinate from its aqueous solution; sulphate of potassa, ferricyanide of potassium, neutral borate, and phosphate of soda, fail to give precipitates. Resinate of baryta is soluble in ether. When resinate of soda is decomposed by an acid, there is formed a milky liquid in which flocculent resin floats about; on being boiled these flocks unite, yielding the resin A. This resin, insoluble in water, soluble in alcohol, ether, and oil of turpentine, exhibits an acid reaction. The alcoholic solution forms precipitates with alcoholic solutions of the acetates of lead and copper; it becomes turbid by the addition of water, but the turbidity disappears on the addition of ammonia.

Investigation of the Resinate B.—This substance is soluble in water and alcohol, but insoluble in oil of turpentine and ether; it contains 16·5 per cent of soda. The chlorides of sodium and barium, form precipitates in the aqueous solution of the resinate B; the sulphates of soda and potassa, the ferro- and ferricyanides of potassium, chloride of potassium, and caustic soda, do not produce precipitates, while the precipitation by means of chloride of barium is incomplete, and the precipitate itself insoluble in ether.

The resin B, set free by the action of an acid, is a brittle brown-coloured substance, soluble in alcohol, insoluble in oil of turpentine, and in ether; the alcoholic solution exhibits an acid reaction. The aqueous solution, from which I separated by means of a weak acid the resin B, having been neutralised with soda, yields, after evaporation to dryness, a residue which on being treated with alcohol gave a resinous matter resembling shellac, and exhibiting a slight acid reaction. This body, C, soluble in water, reduces Fehling's liquor, and precipitates nitrate of silver, and sulphate of copper. By the saponification of resin there are consequently three distinct substances generated, viz., a resinate insoluble in alkalies, a soluble resinate, and a substance which is not separated from its acid solutions.

* Boil pure fatty acids for half an hour with concentrated nitric acid, dilute with distilled water, filter, and next saturate the solution with soda, and on evaporating to dryness there will be left an odorous, yellow-coloured mass, which becomes black on being calcined, thus indicating the presence of organic matter soluble in water. Suberic, pimelic, adipic, propionic, butyric, œnanthylic, succinic acids, and other substances are formed.

The investigation of these resinates has led me to adopt the following process for the separation and estimation of resin in soaps :—Dissolve 10 grms. of the soap in 100 c.c. of distilled water; pour into this solution a slight excess of a concentrated solution of pure caustic soda, whereby the soap of the fatty acids and the resinate A are precipitated and separated from the resinate B, soluble in alkaline solution ; filter, wash with a solution of caustic soda, and add the washings to the filtrate. The alkaline liquor, which contains the resinate B, is acidified with dilute sulphuric acid, boiled, next poured upon a filter previously weighed and dried at 100° upon which the resin B is left. The acid solution (filtrate from B) is carefully saturated with soda* and next evaporated to dryness; the residue is treated with alcohol to separate the sulphate of soda, and the alcoholic fluid evaporated on a previously weighed porcelain basin, the residue of this evaporation being resinoid matter mixed with glycerine. The presence of this latter body may be ascertained by heating the residue in a test-tube with some peroxide of manganese, a few drops of sulphuric acid, and alcohol of 0·824 sp. gr.; formic ether is then formed, and recognised by its smell, which resembles that of peach-blossom.

I have found that at boiling-heat glycerine decomposes iodic acid, so that iodine is set free. This may be detected by its colouring paper previously impregnated with a solution of starch. This reaction is characteristic for glycerine. After having been washed with a solution of soda, the resinate of soda A and the fatty acids are dissolved in boiling water, and next precipitated by a slight excess of chloride of barium ; the insoluble resinate and soap of baryta are separated by filtration, washed and dried at 100°, and next treated with ether, which dissolves the resinate of baryta, leaving the barytic soap in an insoluble state. The ethereal solution is evaporated to dryness and the residue, dissolved in boiling distilled water, decomposed by means of a few drops of sulphuric acid, whereby the resin is set free. This resin is collected on the same filter which already contains the resin B, and having been washed with tepid water is dried at 100° and weighed. The baryta soap suspended in the acidulated water is decomposed by ebullition, and the fatty acids set free are carefully collected and weighed. By this process we ascertain the weight of the resin, fatty acids, and resinoid matter mixed with glycerine and contained in the soap.

It frequently happens that soaps contain large quantities of foreign substances, such as starch (almost always present in soft soap), French chalk, ochre, clay, and the alkaline earthy sulphates, &c., substances fraudulently added for the purpose of rendering soap heavier. These adulterations are readily eliminated by dissolving the soap in alcohol of 0·824 sp. gr., whereby a portion of the chloride of sodium, and the sulphate and carbonate of soda are separated. At the present time the mixing of a concentrated solution of silicate of soda with the still pasty and warm soap mass is very general. I have found a soap of excellent appearance to contain 17 per cent of silicate of soda. As silicate of soda is insoluble in alcohol, it is readily separated by dissolving the silicate in water. The gelatinous silica may be separated either by the addition of a dilute acid, or by boiling with an aqueous solution of chloride of ammonium.

The estimation of the excess of alkali is generally done by treating soap with alcohol, this separates carbonate of soda which is insoluble therein ; but since caustic alkali is soluble in alcohol, I estimate the excess thereof in the following manner :—An alcoholic solution is made of the soap under examination ; after filtering off the matters insoluble in alcohol, the alcoholic filtrate and washings are placed on a water-bath and a current of carbonic acid passed through the alcoholic solution; all the non-combined alkali is thus carbonated, and becomes insoluble in the alcohol. It is then only required to estimate the quantity of carbonated alkali by volumetry, and to calculate from this result to caustic alkali. By means of this process I have been enabled to correctly determine the quantity of alkali saturated by 100 parts of anhydrous fatty acids.* By saponifying with different quantities of soda pure fatty acids, I have obtained 12·3, 12·5, 12·9, 12·4 of alkali, or on an average 12·9 of soda for 100 anhydrous fatty acids. Soap being really salts, it becomes, when the quantity of combined alkali is known, an easy matter to calculate the thereto corresponding quantity of fatty acids, thus reducing the analysis to a simple alkalimetric operation. From 2 to 3 grms. of the soap to be tested are dissolved in alcohol of 0·824 sp. gr., and, without filtration, this solution is placed on a water-bath and treated with a current of carbonic acid; the liquid is next filtered and the filter washed with alcohol ; the filtrate is diluted with water, and then boiled for the purpose of driving off the alcohol; from 5 to 10 c.c. of titrated sulphuric are added, and the liquid kept boiling until the fatty acids appear to be quite clear. After cooling and solidification of the fatty acids, the liquid is filtered and the filter washed with tepid distilled water; and next, the excess of sulphuric acid in the liquid is determined by means of a titrated solution of soda. By means of calculation the quantity of sulphuric acid saturated by the alkali of the soap is found. The quantity of combined alkali contained in 100 parts of soap being known, it is only necessary to multiply the quantity of alkali found by 100, and to divide by 12·6 to obtain the weight of the anhydrous fatty acids combined with the quantity of alkali found. The weight of the fatty acids and alkali together being subtracted from 100, gives the quantity of water and impurities contained in the soap which was tested. This process of analysis cannot be applied when soaps contain resin.

In the case of soap made by empâtage, it is necessary before treatment with alcohol to boil it first in a solution of common salt, for the purpose of eliminating the organic soda-salts (butyrates, hircates, &c.); for as these salts are not decomposed by carbonic acid, they would behave like alkali combined with fatty acids.

Some soaps often contain a large excess of water. Soaps made with cocoa-nut oil contain frequently a fabulously large quantity of that liquid (100 of the cocoa-nut oil yielding 500 soap). It is therefore of importance to estimate the quantity of water. The usual process, drying of from 2 to 5 grms. of soap previously converted into shavings at 100°, does not give satisfactory results ; for while drying, soap swells, and thus retains some water, while a high temperature may cause it to become carbonised. I estimate the water in soap by the following process :—From 1 to 2 grms. of soap-shavings are placed in a previously weighed porcelain capsule and dissolved in the smallest possible quantity of strong alcohol ; next I add a weighed quantity of fine dry sand for the purpose of absorbing all the liquid, and then I dry at 110° ;† the drying proceeds rapidly, and the sandy powder may be used for the purpose of estimating the non-combined fatty matter by treatment with sulphide of carbon.

* If this operation should give rise to the formation of a precipitate, it should be added to that filter which already contains the resin B.

* The theoretical figure as deducted from the formula of the fatty acids would be for tallow, 10·8; for oil, 10·77. According to Rampal, the quantity of alkali contained in soaps should be equal to the tenth part of the weight of the fatty acids; according to Roux and Arnavon, it should be 11·5 per cent; and according to Chevreul, taking the average of the three fatty acids, there should be 12·14 parts of alkali (soda) upon 100 parts of anhydrous fatty acids.

† Before weighing, the capsule containing the dried soap should be placed for the purpose of cooling in an exsiccator (over strong sulphuric acid), as soap is hygroscopic, and would again absorb water from the air.

A NEW AND READY METHOD OF FORMING PLATINUM-BLACK.

By J. LAWRENCE SMITH.

All those who have employed the usual methods of forming platinum-black know that it is attended with

some little trouble: having considerable experience in the decomposing of the platin-chlorides of the alkalies by hydrogen, and by ordinary street gas, the resultant products have been frequently examined, and I find that an excellent platinum-black can be thus prepared; whether equal to the best formed by other processes, I am not prepared to say:—I prefer taking platin-chloride of potassium, and were it not that rubidium and cæsium are too expensive, these would be even better, for their atomic weights are higher than that of the potassium, and consequently the particles of platinum are more widely separated. After the platin-chloride is completely reduced, the mass is treated with water to wash out the chlorides of the alkalies thoroughly; the residue is dried at a temperature not exceeding 220° F., when it is ready for use. The operation can be readily conducted in a capsule of porcelain or platinum; the platin-chloride is introduced, and covered with a circular piece of mica a little smaller than the wide diameter of the capsule, with a hole in the centre, through which the tube conducting the gas is introduced. The capsule is then heated by any convenient arrangement by which a temperature not exceeding 400° or 500° F. is obtained, at which temperature it can be maintained with a little management; a small Bunsen burner with a rosette can be used. If the temperature be too high the platinum-black will not be as good as that made at a lower temperature. Washing the platinum-black, after the chloride is taken out, with a solution of caustic potash or soda, and subsequently washing with distilled water, may improve the product. — *American Chemist.*

ELECTRO-MAGNETIC DEPOSITION OF NICKEL.

By J. M. MERRICK, S.B.

In the following experiments solutions of salts of nickel were subjected to the action of the galvanic current by plunging into the solution a platinum plate, about 3 inches in length by ½ inch in width, connected with one pole of a battery of two medium Grove's cells, while a nickel plate was used in the solution as an anode. In the circuit was placed a sensitive rheostat, by means of which the current could be kept at a definite intensity, and a voltameter, by which the mixed volume of gases from the decomposed water could be measured. From this volume the volume of hydrogen could be ascertained, and from this volume reduced to dryness, zero, and the normal pressure, the amount of metal which should be deposited in a given time could be found.

The weight of metal actually obtained was found by the increase in weight of the platinum slip used as a cathode, which was provided with a platinum wire soldered to it, by which it could conveniently be attached to the balance.

The difference between these weights, taken into consideration with the character of the deposit, shows the value of the solution used for plating purposes. The time of the action of the battery was generally one hour. The observations were made with a good thermometer and a carefully corrected aneroid barometer.

Acetate of Nickel,—Sp. gr. of solution, 1·0232. The deposit was in large measure pulverulent, velvety, and black, consisting of nickel oxide. This was rubbed off before weighing the cathode, and the result of the experiment showed a deposit of metal equal to *one-tenth*, 10 per cent of the amount represented by the liberated hydrogen. Smee remarks ("Manual of Electro-Metallurgy," p. 194) that the acetate is a bad solution for obtaining reguline metal.

Cyanide of Nickel and Potassium.—With this solution there was an abundant evolution of gas from the cathode. The deposit was a dull blackish grey, and streaked.

The amount of metal was 14 per cent of the theoretical quantity.

Chloride of Nickel.—This salt was prepared with care from a nearly anhydrous chloride, and was of a sp. gr. 1·0503.

The deposit was in large measure black, velvety, and easily rubbing off, but leaving a surface of metal underneath.

It gave 83·6 per cent of the theoretical amount of nickel.

The velvety oxide was tested for manganese, but none was found. The character of the metallic as a plated surface was poor. It will be remarked that Smee (*loc. cit.*) extols this solution as excellent for plating purposes.

Sulphate of Nickel.—The solution used was made from a very pure and carefully prepared salt, and had a sp. gr. of 1·0223.

The deposit was blackish, and streaked with a greenish deposit above it. This greenish deposit [subsulphate] having been rubbed off, assuming all the rest to be metal, this solution gave a deposit of 52 per cent of the theoretical amount.

Ammonio-Sulphate of Nickel.—This salt was made by adding an excess of ammonia, and then alcohol, to a strong solution of the sulphate of nickel. The precipitated salt was re-dissolved in water.

The deposit was a greyish-brown "mat" (to use a technical word), with some streaks, but no lustre or polish. It was wholly metallic, however, and amounted to 96 per cent of the required amount.

Ammonio-Chloride of Nickel.—A solution of this salt, prepared like the corresponding ammonio-sulphate, gave a bright metallic streak upon the upper side of the cathode, and the rest of the deposit a dull mat, amounting to 96 per cent of the quantity required by theory.

Ammonio-Nitrate of Nickel.—A solution of this salt, of sp. gr. 1·016, gave a deposit largely greenish (subnitrate?), with a various coloured metallic deposit underneath, amounting to 97·4 per cent of the theoretical quantity.

Sulphate of Nickel.—Another (commercial) sample. In this experiment there was an enormous evolution of gas from the cathode, and a considerable evolution from the anode. The other layer of the deposit was greenish. This, on being rubbed off, left a speckled and blotched metallic surface.

The metal gave 107 per cent of the theoretical amount, showing that some oxide must have been weighed as metal.

Nitrate of Nickel.—This was a solution made from a very pure re-crystallised salt. It gave a thick greenish deposit (subnitrate?), with a metallic layer underneath, apparently equalling 130 per cent of the theory, which simply shows how difficult it is by mechanical means to clean the platinum plate from oxide, or other non-reguline matters, in these bad deposits.

Double Sulphate of Nickel and Ammonia.—This gave a good metallic deposit, equal to 93·5 of the theoretical amount.

Double Chloride of Nickel and Ammonia.—This was a solution of the double salt, containing possibly a trifling amount of alcohol. It gave a pulverulent deposit, with a metallic deposit underneath, dirty looking and striped, equal to 47 per cent of the theoretical amount.

Double Sulphate of Nickel and Potash.—This was a solution of a salt prepared with the utmost care, from presumably pure materials, and re-crystallised.

There was a considerable evolution of gas from the cathode, and the deposit was blackish-green in nodules, with a dull metallic layer underneath. This metallic layer amounted only to 37 per cent of the theoretical amount of nickel.

My experiments seem to show that the number of salts of nickel that will furnish a bright metallic deposit of anything near the theoretical amount is extremely limited.

I find it very difficult to reconcile my results with the sweeping statement of Becquerel ("Elements d'Electro-Chemie," 1864, p. 325), viz., that a brilliant white metallic deposit, of a slightly yellowish tint (un dépot metallique blanc brillant avec une très-légère teinte jaunâtre), can be obtained from a solution of sulphate of nickel in which the excess of acid has been saturated with potassa or soda.

SUGGESTIONS FOR THE EFFECTIVE WORKING OF THE ADULTERATION OF FOOD, DRUGS, &c., ACT, 1872.

The following is the Report read at a large Meeting of the Association of Medical Officers of Health, held October 28th, 1872 :—

1st.—That, in their opinion, the Adulteration of Food Act, 1872, notwithstanding its imperfections, is capable, with proper management, of being made an important and valuable public measure; but to this end it will be necessary to carry out its several provisions in the fullest and fairest manner, having proper regard for the interests of commerce and trade, as well as for those of the public.

2nd.—That if the Act be put in force in this Metropolis, it will be most desirable and expedient that the several analysts appointed by the Vestries and District Boards should work conjointly, and in accordance with some prearranged system. This will not only be the means of securing uniformity of results and agreement of opinions, but it will also serve to check the conflict of scientific testimony, and will afford the best guarantee for the full, fair, and effective working of the Act.

3rd.—That to this end, as well as for the sake of economy, it is advisable that all the work of analysis throughout the Metropolis should be performed in as few laboratories as possible, say two; and that skilled assistants should be constantly engaged therein to conduct the analyses, under the superintendence and in the presence of the appointed analysts.

4th.—That as this will entail a large expense, it will be necessary for each of the Food Analysts appointed by the Vestries and District Boards of the Metropolis to contribute, *pro rata*, according to the amount of work done, towards the maintenance of the said laboratories, &c.

5th.—That, guided by the practical experience of two of the members of the Committee, namely, Dr. Letheby, the Professor of Chemistry in the College of the London Hospital, and Dr. Stevenson, the Lecturer on Chemistry at Guy's Hospital, the Committee are of opinion that the work of Analysis, &c., under the Act, cannot be fully and effectually performed at a less charge to the Vestries and District Boards of the Metropolis than from one to two hundred pounds per annum to each of the appointed analysts; for, in considering the question of salary, the Committee have had regard not merely to the great expenses of the laboratory, but also to the time and attention required from each of the analysts, in the supervision and conduct of his laboratory work, and in the proceedings which must arise out of it.

6th.—The Committee are strongly of opinion that if a too strict economy is exercised by the local authorities who are appointed to carry out the provisions of the Act, whether in this metropolis or in the country, the objects of the Act will not be attained, and the interests of the public will not be served; for the Act will either become a dead letter, as in the case of the Act of 1860, or it will be made the medium of persecution, and perhaps also of the most offensive quackery. Already there is evidence of this, and we submit, for the earnest consideration of local authorities, that those who are appointed analysts under the Act should be strictly debarred from giving any certificate or testimonial as to the purity or impurity of any article of food, or drink, or drug, other than for the purposes of the Act, and every certificate should be so worded as to prevent its use for advertising trade purposes.

7th.—That as the success of this Act will largely depend on the manner in which the duties cast on the Inspector are carried out, it is considered advisable that he should be under the direct control of the local authority, or of the analyst, in purchasing or procuring samples of food, drink, or drug, for analytical examination.

Hy. Letheby, M.B., *President.*

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 1st, 1872.

Rev. William Gaskell, M.A., Vice-President, in the Chair.

Among the donations announced were a beautiful photographic copy of a fine portrait of the late Mr. John Dawson, of Sedburgh, by Mr. Westall, A.R.A., and a fine photographic portrait of the Rev. Canon Sedgwick, M.A., F.R.S., Honorary Member of the Society, both presented by Canon Sedgwick.

On the motion of Mr. Baxendale, seconded by Mr. Kipping, the thanks of the Society were unanimously voted to the Rev. Canon for his interesting and valuable donations.

"*On the Composition of Ammonium Amalgam*," by R. Routledge, B.Sc.

The substance now known as ammonium amalgam appears to have been first obtained by Seebeck* in the beginning of the year 1808, immediately after Davy had announced his brilliant discovery of the isolation of potassium and sodium by means of the Voltaic battery. Seebeck prepared the amalgam by placing mercury which formed the negative pole of a battery in contact with moistened carbonate of ammonia. About the same time Berzelius and Pontin† obtained the like result with solution of ammonia. This discovery they communicated to Davy early in June, 1808, declaring their conviction that ammonia, like potash and soda, must be an oxide, and that the new substance was a combination of its metallic constituent with mercury. Davy‡ immediately commenced a series of elaborate experiments on the production and properties of the amalgam; and in an account of these experiments laid before the Royal Society in the same month, he first uses the name ammonium to indicate the supposed metallic basis of ammonia. So convinced was Davy that the substance united with mercury in the amalgam was of a metallic nature, and that by combining with oxygen it constituted ammonia, that he was inclined to view nitrogen and hydrogen, if not as oxides of metals, at least as metallic gases.

Davy discovered that the ammonium amalgam was readily produced when an amalgam of potassium was made to act on moistened sal-ammoniac. He found that the electrically prepared amalgam when introduced into a tube rapidly evolved gas, which he describes as consisting of "about two-thirds to three-fourths of ammonia, and the remainder hydrogen." In another experiment, amalgam obtained by potassium was moistened with strong liquid ammonia, and when heated in a tube generated gas which was proved to consist of two-thirds ammonia and one-third hydrogen.

In the following year Gay-Lussac and Thénard‖ investigated the ammonium amalgam, and were led to regard it as a triple compound of mercury, ammonia, and hydrogen. They found on putting some of the amalgam prepared by potassium into a tube which was filled up with mercury and then inverted in a vessel of that liquid, that the amalgam gave off, in decomposing, ammonia and hydrogen gases in the proportion of 2½ volumes to 1. But the electrically prepared substance gave off the gases in quite another proportion, the ratio in four different experiments being nearly as 28 volumes of ammonia to 23 of hydrogen. These results were obtained by first drying the amalgam with bibulous paper, then introducing it into a tube containing a little mercury, closing the tube with the finger, agitating it for some minutes with the enclosed

* *Annales de Chemie*, lxvi., 191.
† Gilb., vi., 260, and *Bibliotheque Britannique*, No. 323, 324, p. 122.
‡ *Phil. Trans.*, 1808, p. 355.
‖ "Recherches Physico-Chimiques," i., 52.

air, opening the tube after inversion in mercury, measuring the ammonia by absorbing with water, and determining eudiometrically the hydrogen mixed with the residual air. The amalgam was afterwards described by Thénard, in his "Traité de Chimie,"* under the name of "ammoniacal hydride of mercury."

It is interesting to observe that in 1816 Ampère,† in the passage where the now universally received views on the constitution of ammoniacal compounds are first propounded, refers to the amalgam. Speaking of the difficulty of assimilating the constitution of ammoniacal to metallic salts, he remarks—"This difficulty would disappear if we admit that, just as cyanogen, although a compound body, exhibits all the properties of the simple bodies which are capable of acidifying hydrogen, so the combination of one volume of nitrogen and four volumes of hydrogen which is united to mercury in the amalgam discovered by M. Seebeck, and to chlorine in the hydrochlorate of ammonia, behaves in all the compounds which it forms like the simple metallic substances." This theory was more fully developed by Berzelius, and was soon generally received, except as regards the amalgam, concerning which various conflicting opinions were entertained. Daniell,‡ for example, speaks of it as a mere mixture of mercury and gases resulting from the cohesion of the mercury and the adhesion to it of the gases, and he cites the absorption of oxygen by melted silver as a similar case.

Grove,‖ in 1841, made a few experiments on the amalgam, and advanced the idea that it is a chemical compound of mercury and nitrogen, merely swelled up with hydrogen.

In 1864, Dr. Wetherill§ performed several ingenious experiments on the amalgam, without, however, attempting any quantitative estimate of its composition. He concludes that it is not an alloy of mercury and ammonium, and that the swelling up of the mass is due to the retention of gas bubbles by virtue of some unexplained action which he somewhat vaguely refers to catalysis.

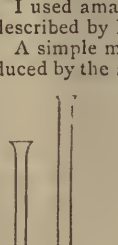
In the *Annalen der Chemie du Pharmacie* for 1868¶ is a paper by Landolt, in which, after pointing out the discordance of the quantitative results obtained by Davy, and by Gay-Lussac and Thénard, he describes a method by which he attempted a new determination of the relative quantities of ammonia and hydrogen. He prepared the substance from a solution of sal-ammoniac, separated from the mercury, which formed the negative pole, by a porous cell. The amalgam, when removed from the circuit, was washed in a stream of water to get rid of the adhering solution of sal-ammoniac, which always contains free ammonia. It was then immediately plunged into dilute hydrochloric acid of known strength, and the hydrogen evolved was received into a graduated cylinder placed over it, while the ammonia was estimated by determining the amount of unneutralised acid in the liquid. Two experiments gave results corresponding respectively to 2·15 and 2·4 volumes of ammonia to 1 of hydrogen. These figures of Landolt's cannot be considered satisfactory, neither nearly agreeing with each other, nor approximating to the ratio 2 : 1 sufficiently closely to justify his conclusion that they "completely confirm the results formerly obtained by Davy." Indeed Landolt points out a serious defect in his process, namely, that however rapidly the amalgam may, after washing, be transferred into the acid, the adhering water will nevertheless take up some more ammonia from the continuously decomposing substance while the hydrogen escapes.

It must be observed that Davy himself appears to have found a difficulty in obtaining consistent results, for he does not seem to have ever entirely satisfied himself as to the proportions of the two gases. These are the words in which he sums up his observations:—"As it does not seem possible to obtain an amalgam in an uniform state, as to adhering moisture, it is not easy to say what would be the exact ratio between the hydrogen and ammonia produced, if no more water was present, than would be decomposed in oxidating the basis. But in the most refined experiments which I have been enabled to make, this ratio is that of one to two; and in no instance in which proper precautions are taken is it less, but under common circumstances often more. *If* this result is taken as accurate . . . .", &c.*

This statement of Davy's being apparently the only authority for the assertion that the decomposing amalgam gives off the gases in atomic proportions, and yet being in conflict with Gay-Lussac and Thénard's results, it appeared to me desirable to attempt to obtain more exact determinations.

I used amalgam prepared by electricity in the manner described by Landolt.

A simple mode of eliminating the disturbing effect produced by the attraction of ammonia for moisture suggested itself. A U-shaped glass tube was provided, open at both ends, about 1·4 centimetres in diameter, and having its shorter limb 40 centimetres long. At the bottom of the longer limb, just above the bend, there was an outlet tube to which was attached a piece of caoutchouc tubing closed by a pinch-cock. Mercury was poured into the tube until it filled about two-thirds of the shorter limb, into which was then introduced the amalgam after the latter had been wiped with filtering-paper. Then into the end of the limb containing the amalgam, a caoutchouc stopper, perforated with a small opening, was immediately thrust so far that its upper surface came a little below the rim of the tube. The decomposition of the amalgam was then allowed to proceed for a few minutes, during which period any moisture adhering to the amalgam or present in the tube would become completey saturated with ammonia, and then the two gases would begin to escape through the perforation in the stopper in the proportions in which they are really evolved. Mercury was now poured into the open end of the longer limb until the amalgam just made its appearance at the top of the hole in the stopper, which was then closed by pushing in a piece of glass rod. The evolved gases being now retained in the tube pressed up the mercury in the longer limb, and it was from time to time drawn off by the outlet tube to prevent undue pressure on the stopper. When the decomposition was complete, which usually occurred in about 1½ hours (but in one case more than 2½ hours were required), the mercury was brought to the same level in both limbs and the space occupied by the gases was marked on the tube. A little mercury was then let out so as to make the pressure on the gas somewhat less than that of the atmosphere, and the space above the stopper was filled with hydrochloric acid diluted with a little water. The glass rod was then carefully withdrawn for an instant so that a few drops of the acid might enter the tube. The ammonia gas present was of course immediately absorbed, and the mercury having been again brought to the same level in both limbs, the space occupied by the residual hydrogen was marked on the tube. The volumes occupied by the gases were determined by finding the quantity of water required to fill them from a burette.



The following are the results of four experiments:—

No. of Experiment.	Volume of the Mixed Gases.	Volume of Residual Hydrogen.	Volume of Ammonia Absorbed.	Volumes of Ammonia found for one Volume of Hydrogen.
	c.c.	c.c.		
1	20·8	7·0	13·8	1·97
2	18·2	6·2	12·0	1·93
3	12·8	4·3	8·5	1·98
4	13·6	4·6	9·0	1·95

* Bakerian Lecture, 1809.

* Vol. ii., p. 162, 3me ed.
† *Annales de Chimie et de Physique*, ii., 16, Note.
‡ "Chemical Philosophy, p. 420.
§ *Phil. Mag.*, United Series, vol. xix., p. 97.
‖ *Silliman's Amer. Journal* [2], xl., 160.
¶ "Supp. Bd., vi., p. 346.

I believe these figures are as nearly accordant with the atomic proportions as could be expected from the means employed, where the possible error in determining the volumes might amount to perhaps 0·2 c.c.

In another similarly conducted experiment, in which it was sought to obtain as much gas as possible, the tube was closed too soon, and the result showed a deficiency of ammonia, but is otherwise interesting:—

Experiment 5.

Volume of Mercury in the Amalgam.	Volume of Amalgam.	Volume of the Mixed Gases.	Volume of residual Hydrogen.
11·8	30·5	49·0	18·0

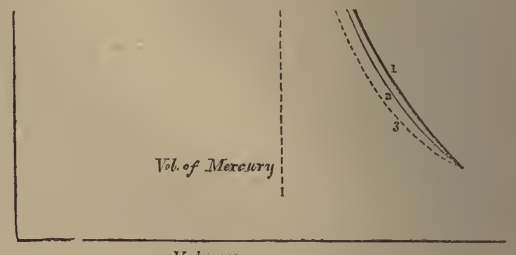
A new observation on the amalgam has recently been made in America by Professor C. A. Seeley,* who found, by subjecting it to varying pressure that its volume changes, apparently in accordance with Mariotte's law. He employed simply a glass tube fitted with a plunger, and did not measure the pressures or volumes. His conclusions were that the amalgam is a mechanical or physical mixture of liquid mercury with the gases ammonia and hydrogen, and that its semi-fluid consistence is due to the mixture having the nature of a froth.

Being desirous of submitting Seeley's remark on the compressibility of the amalgam to the test of direct measurement, I subjected the electrically formed amalgam to pressure in a glass tube 48 centimetres long, and 1·3 centimetres diameter. The pressure was applied by connecting the tube with a syringe, by which air could be forced into the apparatus, and the amount of the pressure was measured by a column of mercury in an open manometer. There was some difficulty in measuring the volume owing to the occasional escape of bubbles of gas, which caused abrupt alterations of the level. The results obtained are given in the following table, which also contains a column of volumes calculated on the supposition that the amalgam is a mere mixture of fluid mercury and gas, allowance being made for the pressure on the gas due to the column of mercury in the amalgam itself. The extreme case was assumed, namely, that this additional pressure is represented by a column of mercury half the height of the amalgam.

No. of Experiment.	Vol. of Mercury in the Amalgam. c.c.	Atmospheric Pressure in Centimetres of Mercury.	Vol. of Amalgam under Atmospheric Pressure c.c.	The Increased Pressure in Centimetres of Mercury.	Observed Vol. of Amalgam under Increased Pressure. c.c.	Calculated Vol. of Amalgam under Increased Pressure. c c.
6	14·5	76·2	21·0	152·4	18·0	17·9
7	11·9	76·8	23·0	188·2	17·5	17·1
8	11·9	76·8	22·7	200·9	17·0	16·4
9	24·4	76·2	36·2	152·4	31·6	30·9
10	24·4	76·2	31·6	152·4	28·0	27·4
11	13·2	76·2	28·7	152·4	23·0	21·6
12	13·2	76·2	22·5	152·4	18·5	17·2
13	10·4	76·2	18·0	186·3	14·7	13·7
14	10·4	76·2	16·0	186·3	12·8	12·8
15	23·8	76·2	40·4	178·7	33·6	31·9
16	23·8	76·2	42·0	176·1	33·6	32·7
17	23·8	76·2	42·8	152·6	35·0	34·7
18	23·8	76·2	40·4	177·4	33·3	31·9
19	23·8	76·2	42·2	102·6	38·8	38·5
20	23·8	76·2	42·2	153·6	34·0	34·0
21	23·8	76·2	42·2	177·4	33·0	32·7
22	23·8	76·2	42·0	201·5	32·2	31·6
23	23·8	76·2	40·2	177·4	32·2	32·1
24	23·8	76·2	40·6	201·5	31·2	30·6
25	23·8	76·2	36·2	149·5	32·6	30·6
26	29·2	76·2	42·0	177·4	36·8	35·4
27	29·2	76·2	42·0	200·2	36·2	34·7
28	29·2	76·2	40·6	173·6	36·0	34·7
29	29·2	76·2	39·5	198·9	34·4	33·4
30	24·6	76·2	32·0	155·9	29·7	28·4
31	24·6	76·2	34·0	177·4	30·4	28·7

* CHEMICAL NEWS, June 10, 1870

Five points deduced from the mean results of experiments 15 to 24 having been laid down in relation to rectangular axes, the curve (1) which passed through them is represented in the diagram, which shows also the curve (2) through five points representing the calculated volumes, and a line (3) representing volumes corresponding to the



pressures which were applied to the top of the columns of amalgam.

The diagram and figures sufficiently show that the compressibility of the amalgam agrees nearly with the supposition of its being a mixture of gas and mercury, but that it is, however, somewhat less compressible. This, no doubt, is owing chiefly if not entirely to its want of fluidity.

I think that from these experiments I am warranted in drawing the two following conclusions, viz.:—

(1). In the fact of the gases being evolved in atomic proportions, we have the clearest proof that the ammonia and hydrogen are chemically combined.

(2). The compressibility of the mass proves that the enlarged volume or swelling up is due mainly, if not entirely, to free gases entangled in it.

In connection with the first of these conclusions arises the further question whether the NH_4 is combined with the mercury. That it is so combined appears in the highest degree probable from the apparently uniform diffusion of the NH_4 throughout the mass, and from the fact that such a union would be only one additional instance of the innumerable cases in which this radical plays the part of a metal. Seeley says, that if the radical NH_4 be contained in the amalgam at all, it must be in the state of gas. But the figures furnished by my fifth experiment show that if this supposed NH_4 gas had the normal molecular volume, and existed in the amalgam from the beginning, a force of two atmospheres would be required to compress it within the amalgam. The decomposition therefore is progressive, and points to the existence of a real compound of NH_4 with the mercury. We may therefore admit, that such a compound is originally formed, and decomposes rapidly into mercury, ammonia, and hydrogen, while the gases becoming entangled in the mass impart to it that remarkable turgescence, which is not, however, a property of the original compound (or ammonium amalgam), but merely an accidental result of its decomposition.

As to the cause of the retention of the gases, I am not prepared to offer an opinion, further than that its explanation would probably involve physical rather than chemical considerations.

I have to express my obligation to the kindness of Dr. Roscoe for the use of the appliances of the laboratory at Owens College, where the experiments were carried out, and I am also indebted to him for valuable suggestions.

Sir Humphry Davy, Bart.—A colossal statue, which has cost £600, has been erected to the memory of Sir Humphry Davy at Penzance, his native place. The statue is placed in front of the Post-Office, near to the birthplace of the great philosopher.

NOTICES OF BOOKS.

Statements relating to the Home and Foreign Trade of the Dominion of Canada; also Annual Report of the Commerce of Montreal for 1871. By Wm. J. Patterson, Secretary to the Board of Trade. Montreal: "The Gazette" Printing House. 1872.

Mineral Resources North of Port Augusta. Ordered by the House of Assembly to be printed and lithographed, April 17th, 1872.

Mineral Statistics of Victoria for the Year 1871. Presented to both Houses of Parliament by His Excellency's Command. Melbourne: John Ferres.

Although the first two reports do not include subjects that we can discuss, we must bear witness to the extreme care and accuracy with which the matter has been collated. In the third report, however, there is much that will interest our readers, especially in the laboratory report by Mr. J. Cosino Newberry, B.Sc., Analyst to the Mines Commission, under whose direction over one hundred analyses, examinations, and assays have been made during the past year. The mining assays have only a local interest, and we omit them—unwillingly, because of the care which they evince; but the analyses of rocks and minerals are too instructive to be so summarily disposed of. An analysis of halotrichite, from near Mudgee, N.S.W., crystallised in needles, and massive, colour white, shows the composition to be—

Alumina	11·67
Magnesia	4·41
Sulphuric acid	39·88
Cobalt	traces
Iron	,,
Soda	,,
Water	42·24
Silica	0·20
	98·40

A dense, flint-like rock, of yellow colour, occurring in granite, gave—

Silica	98·10
Alumina	1·77
	99·87

Fibrolite, from Gippsland, gave—

Silica	36·90
Alumina	60·73
Lime	0·63
Magnesia	0·33
Water	1·50
	100·09

Infusorial earth, from near Talbot, occurring in quantities, and of considerable value, gave—

Silica	83·88
Alumina	7·41
Lime	1·24
Magnesia	0·75
Water	6·23
	99·51

Fire-clay, bricks of which stand a high temperature without softening or cracking, the most extreme heat of an assay furnace being insufficient to round the thin edges, gave—

Silica	67·2
Alumina	29·0
Water	4·0
	100·2

Analyses were made with the view of ascertaining the nature of the so-called lava-streaks found cutting the silurian shales and sandstones in various rocks, and the results prove that they are more or less decomposed dyke-stones, probably basaltic. Of a rock, 51·78 per cent of which was soluble in hydrochloric acid, the soluble portion gave—

Water	13·81
Silica	8·81
Alumina	18·01
Peroxide of iron	8·80
Lime	2·34
Magnesia	trace
Potash	0·90
Soda	trace
Phosphoric acid	0·40
Soluble sulphates and chlorides	trace
	53·07

The excess in the analysis is probably due to the oxides of iron being determined as peroxides. They occur as protoxide, peroxide, and magnetic oxide. The insoluble 48·22 per cent consisted of—

Silica	33·75
Alumina	13·77
Lime	0·70
	48·22

Some experiments were made with the view of finding means of clearing the muddy waters of reservoirs. The purest waters are, as a rule, those in which mud and organic matter remain longest in suspension. Water from the Expedition Pass Reservoir stood in a bottle in the laboratory for more than six months without depositing the clay held in suspension. The soluble matter was chiefly chloride and carbonate of sodium, and was present in only small quantity. Another water stood for three months with like results. Both waters contained more clayey than organic matter, and were rendered clear by an addition of chloride of calcium. One part of this salt in 1000 of water cleared it in less than one hour; 1 part in 2500 of water, in five hours; 1 part in 5000, in six hours; 1 part in 10,000, in twenty-four hours. When, however, the water contained more organic matter than inorganic or clayey matter in suspension, the calcium salt did not act so readily, but was aided by an addition of lime: as little as two grains of quick-lime cleared a gallon of water in twelve hours. Three or four grains of alum or chloride of aluminum answered the same purpose; but there are many objections to the use of alumina salts.

We have selected but few of the tabulated results, the entire arrangement of which may be fully commended to the reader.

El Aqua del Rio de la Plata su Analisis Quimico con Observaciones sobre las Variaciones en su Composicion; informe presentado á la Comision de Aquas Corrientes de la Ciudad de Buenos-Aires. Por Juan J. J. Kyle, Catedrático de Quimico en el Collegio Nacional. Buenos-Ayres. 1872.

This small pamphlet contains valuable information as to the chemical composition of the waters of the rivers Rio de la Plata, Rio Parana de las Palmas, and that of the water supplied to the city of Buenos-Ayres. The author has analysed the water of the above rivers at various depths and in various states of the tide. The result of this analysis he gives in two tabulated forms, from which it appears that the water tested was of medium purity, as also was that supplied to Buenos Ayres.

The method of analysis used was that recommended by Messrs. Wanklyn and Chapman.

CORRESPONDENCE.

VANADIUM IN TRAP-ROCKS.

To the Editor of the Chemical News.

Sir,—I trust you will allow me a little space in your paper for some observations on the prospective importance of such researches as those of Mr. Apjohn, published in your last issue. The earlier chemical history of rock masses was confined to empirical analysis, including only the most common elements. Two important steps have been taken in advance—one by Professor Haughton, the other by Bunsen. The former showed, by the discussion of his analyses of felstones, that these may be regarded as mixtures of orthoclase and quartz. Bunsen deduced a theory, from his examination of the igneous rocks of Iceland, that all such rocks may be referred to two types, some belonging to one type, some to the other, and the remainder being mixtures of the two in various proportions, the proportions being determinable by analysis. There are trap-rocks in the Isle of Man which cannot be brought within the scope of Bunsen's formulæ; but this proves nothing against the *idea* involved—it only shows that Bunsen's experiments did not cover ground enough to enable the formulæ of the two fundamental types to be determined. The third great step which, as it seems to me, remains to be taken, is that foreshadowed by the work of those who, like Mr. Apjohn, seek for the rarer elements in common stones.

Geologists divide all rocks into two classes, the igneous and the aqueous. The aqueous rocks, being derived from the igneous, must, viewed generally, have the same ultimate chemical composition, *minus* what has been washed out by water. The difference between the two kinds of rocks accumulates in the sea in the form of salts held in solution. Some of these salts must have gone on accumulating in the sea since water first began to condense upon the solidifying poles of the once fluid earth; other of the salts have continually been segregated out by organisms, to form the carboniferous strata. As the igneous rocks which protrude through the older strata rarely contain carbonic acid, it seems reasonable to suppose that nearly all the carbonic acid contained in the sea-deposited carboniferous rocks was once atmospheric. If so, the pressure of the atmosphere must, in early geological eras, have been enormously greater than it now is, and consequently the early sea have been once at far above the temperature at which water now boils. The powerful chemical action of water heated under pressure in an atmosphere of carbonic acid has been often insisted upon as a means of accounting for the large proportion of salts contained in some mineral waters. The decomposition of the alkali and alkali-earthy silicates of the primordial earth-surface must therefore have proceeded at a far more rapid rate in early ages than in later times. Meanwhile the more soluble constituents were constantly being dissolved out of the rocks, in part to go on accumulating in sea-water to this day, and in part to furnish the cases or skeletons of organisms, which to this day are being deposited to form ocean bottoms. Speaking generally, the insoluble residue ultimately left of the igneous rocks, after repeated denudation, re-melting, degradation, and re-deposition, would be mainly a silicate of alumina or clay. It is common with geologists to speak of all these rocks as if their ultimate composition were the same; but the well-known difference in fusibility between the aqueous and the igneous rocks is alone sufficient to show that the composition is different, and different in the direction that might have been predicted.

If the proportion of, say lime, in the oldest igneous and the newest sedimentary rocks were known, the difference would be represented by the lime present in those carboniferous strata that have been formed by organisms out of the sea, taken together with the comparatively insignificant portion remaining in solution. If the total quantity of lime so segregated were known, the mass of original igneous rock acted upon might be calculated. Such data cannot be obtained; but if we take, say vanadium, and ascertain, by sufficiently numerous experiments, an approximation to the proportion of it contained in the oldest igneous rocks, and prove either its absence, or determine its proportion, in the later sedimentary rocks, then we may look in the existing sea for the whole of the difference. Now it is very easy to detect vanadium in sea-water, and it could not be very difficult to determine the proportion in which it is present. This once known, the total quantity contained in the ocean could be roughly calculated, and hence the total thickness of original earth-crust that had been acted upon by the sea. Such a calculation could be verified or controlled by the discussion of the data afforded by corresponding experiments, as to the proportions present in the two kinds of rock and in sea-water, of other elements, as iodine or osmium.

I have assumed in this argument that the earth's crust was originally homogeneous, of the same chemical composition throughout, with the rarer elements equally diffused. This assumption is not, however, essential for the end in view, provided an average composition can be established for the older igneous rocks. Many of the trap-rocks are doubtless only sedimentary rocks re-melted. Most are probably a mixture of re-melted aqueous rocks, with original earth-crust. Other things being equal, those igneous rocks which protrude in great mountains through the older sedimentary strata, and which possess a great equality of composition all round, would be most likely to represent the original earth-crust. Such a mountain is that of Penmaenmawr, in North Wales. The rock known as Rowley Rag, near Birmingham, closely resembles it in chemical character. By a comparison of a sufficient number of specimens of such rocks from different localities, with respect to the proportion—say of vanadium—contained in them, it would become known how far such proportion might be trusted as an indication of the original constitution of the rock. Further examination of specimens from trap-dykes traversing more recently deposited rocks would show if the proportion of the vanadium was less in such; and ultimately the true proportion contained in the original crust would be inferred, together with a means of judging of the origin of traps and basalts. If such a result were not obtained, even, it would be worth while to know that the contrary proposition was true,—that the composition of the earth's crust was not originally homogeneous; and one or the other conclusion must result from sufficient investigation, conducted as here suggested.

But the assumption of the original homogeneity of the earth's crust is not without facts in its support. The search after the rarer elements has not been diligent enough, nor are the methods of detecting them, when present in small proportion, effective enough, to justify any conclusion as to their total absence from ordinary rocks. Some of the elements most sought after, and others the means of detecting which are extremely delicate, are known to be almost universally diffused. Gold, silver, copper, and iodine, come into this category. Platinum appears to have been found whenever sought for in the larger masses of igneous rocks. The mountains of Auvergne, in France, are known to contain it throughout. It is present in the Penmaenmawr rock, and in all the clays I have ever examined for it, which are many. The close general chemical resemblance between great masses of igneous rocks, all the world over, is well recognised. What is now needed is, to trace the rarer elements through all these, and to follow up their disappearance—for such of them as do disappear—into the later sedi-

mentary rocks. Then the elements missing in the latter should be found in sea-water.

The great diversity of minerals, the accumulation of rare elements in special localities, and the various dominant mineral characteristics of different countries, furnish no valid argument against the position here taken. For what forces have been at work! and for how long? The most complex and rare of minerals are found just where they might be expected to be found—in high latitudes. For then great geological changes must first have begun, and gone on under the influence of water, while as yet no crust was formed in equatorial regions, since astronomers tell us that the axis of the earth has not changed its position from the earliest times, except within the swing of the precession of the equinoxes. It seems as if all accumulations of special minerals had taken place very gradually, and under influences which, however obscure, are not utterly unintelligible. Mineral veins are usually found in the neighbourhood of faults, which, by causing the formation of cavities, determine the drainage from, it may be, miles of superincumbent rock, and from a surface hundreds of miles in extent. When we consider that from any ordinary piece of slate (and still more of a trap-rock) traces of metals, precipitable from acid solution by sulphuretted hydrogen, may always be obtained, it is not wonderful that the drainage from probably hundreds of cubic miles of rock, all converging to one axis, should fill up cavities with deposits of minerals in abundance, the elements of which can only with difficulty be detected in the parent rock. Then either denudation of miles of superincumbent rock, or upheaval, or alternations of both, proceeding through geological eras, make such deposits accessible, and at the same time make the origin obscure. Vanadium appears to be an element the estimation of which in rocks is well adapted for the purpose of distinguishing between the two great classes of rock, with their varieties. It must be an element that water extracts with some ease, or the sea could not contain so much as that a tumbler full of sea-water should suffice for its detection, while it is classed among the rarest of terrestrial elements. —I am, &c.,

E. SONSTADT.

Ramsey, Isle of Man,
October 21, 1872.

PS.—I have referred to the detection of vanadium in sea-water; and, although it is well known that vanadium must be there, since it is found in crystals from the mother-liquors of the soda manufacture, yet it may be expected that I should state the method I have followed of directly detecting it. If to a specimen of sea-water about a fourth of its volume of a saturated solution of pure iodate of potassium is added, after a few hours a precipitate forms, consisting essentially of iodate of calcium, but containing vanadium, and giving the usual blowpipe reeactions of vauadium. I have used other methods, but this is the best.

A great number of salts, more or less soluble in pure water, are totally insoluble in a strong solution of iodate of potassium. Didymium, for instance, is so completely precipitated by this reagent, that the filtrate gives, through a thickness of several inches, no trace of absorption lines in the spectroscope. The alkalies, magnesia, alumina, and glucina, are not precipitated. Stas had difficulty in procuring iodate of potassium that remained colourless on exposure to the air. But if a solution of iodate of potassium is concentrated sufficiently to crystallise slightly, every trace of impurity capable of causing colouration of the crystals goes down with the first crop; and subsequent crops of crystals are snowy-white and permanent in the air, and do not give a coloured bead before the blowpipe. The precipitate which iodate of potassium gives with sea-water appears to contain osmium as well as vanadium, and even in larger proportion. If alcohol is added to the sea-water a few hours before the addition of the iodate, the precipitate is free from both vanadium and osmium. —E. S.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, October 21, 1872.

In addition to a large number of original memoirs and papers relating to mathematics, physics, geography, meteorology, applied and pure mechanics, and astronomy, this number contains the following original paper relating to chemistry:—

Action of Crystallised Sugar upon the Cupro-Potassic Reagent of Barreswil.—E. Feltz.—After first observing that the estimation of glucose is based upon the reduction of the cupro-potassic liquor heated to ebullition, the author states that it has been inferred that refined and crystallised sugar exerts no action upon the reagent alluded to, and describes at length a series of experiments from which it appears that pure and best refined sugar also gives the well-known reaction—viz., separation of sub- or red oxide of copper, especially in the presence of an excess of alkali. While the author remarks that Dr. Scheibler pointed out in 1869 that the estimation of glucose is vitiated in a mixture of the two sugars under certain conditions, he forgets that many years ago the late Dr. G. J. Mulder, in an essay on sugar, proved that the cupro-potassic test fails unless it is carefully prepared, and that no higher temperature than about 80° or 90° should be applied; as above that temperature even the cupro-potassic liquor alone is liable to reduction (see *Jahresbericht über die Fortschritte der Chemie, von J. v. Liebig und H. Kopp, für* 1850, pp. 614, 675, 676).

La Revue Scientifique de la France et de l'Etranger, October 26, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following memoirs:—

Geology of the Secondary and Tertiary Basins of the Sub-Cévennic Region (Région sous Cévennique).—Dr. Bleicher.—Illustrated with woodcuts and diagrams.

Glycogenesis in the Invertebrate Animals, and General Character of Nutrition and Glycogenesis.—Dr. C. Bernard.—The continuation of a series of lectures on general physiology.

Neues Jahrbuch für Pharmacie und Verwandte Fächer, von Dr. F. Vorwerk, January, 1872.

This number (which has been delayed in transmission) contains the following original papers relating to chemistry:—

Analysis of Potable Waters by means of a Titrated Soap-Solution.—Dr. Graeger.—The detailed account of a peculiar volumetric method of water analysis by means of an alcoholic soap-solution of known strength. It appears from the results of this method, as compared with the gravimetric method, that for practical purposes this plan of analysis is sufficiently correct to estimate the carbonate of lime, lime, magnesia, sulphuric acid, chlorine, and carbonic acid in drinking water.

Formation of Corrosive Sublimate in Powders Containing Calomel.—G. Vulpius.—The author has instituted a series of experiments to ascertain the correctness of the assertion that calomel when mixed with other powders becomes converted into corrosive sublimate; the results of these researches may be summarised as follows:—No corrosive sublimate is formed within twenty-four hours when calomel is mixed with saccharum album, saccharum lactis, magnesia usta, magnesia hydrico-carbonica, and natrium bicarbonicum. After three months no corrosive sublimate is formed in mixtures of calomel with magnesia usta, magnesia hydrico-carbonica, and any kind of refined sugar or milk-sugar, but faint traces are formed in mixtures containing calomel, natrium bicarbonicum, and refined lump-sugar. By treatment with water, corrosive sublimate is only formed in such mixtures of calomel as contain magnesia usta and bicarbonate of soda. Rather large quantities of sublimate are formed in powders composed of calomel, sugar, and bicarbonate of soda, if the mixture becomes damp and is kept for a long time. No sublimate is formed when a powder consisting of calomel and bicarbonate of soda is digested with water acidulated with hydrochloric acid. Pepsin does not favour the formation of corrosive sublimate.

Hager's Method for the Quantitative Estimation of the Cinchona Alkaloids by means of Picric Acid.—O. Medin.—This essay treats at great length on the quantitative estimation of the cinchona alkaloids by precipitation with a solution of picric acid; the quantity of alkaloids present in cinchona barks may thus be readily and accurately ascertained.

February, 1872.

This number contains no original papers relating to chemistry.

March, 1872.

Some Double Salts of Protoxide of Iron, and their Applicability for Titrating the Solution of Permanganate of Potassa.—Dr. Graeger.—This essay contains the detailed account of the behaviour of the following double salts of iron with permanganate of potassa solution of a known strength:—Sulphate of protoxide of iron and ammonia, potassa, soda, magnesia, and oxide of zinc.

Some Reactions of Quinine and Morphine.—F. A. Flückiger.—The results of the author's researches may be summarised as follows:—The thalleiochin reaction is limited to from 1-4000th to 1-5000th; Vogel's reaction with ferrocyanide of potassium is not so sensitive. Very dilute solutions of quinine are best detected by the bromine reaction, which indicates even 1-20,000th of the alkaloid; by means of chlorine-water and ammonia, 1-1000th part of morphine may be detected, while the iodic acid reaction is ten times more sensitive. Bromine and ammonia are useless for the detection of morphine; in a mixture of salts of quinine and morphine, the test for either of these bases may be called forth at will by means of chlorine and ammonia.

April, 1872.

Preparation of Pure Hydrochloric Acid.—Th. Diez.—The crude hydrochloric acid of commerce is first diluted, by the addition of water, to a sp. gr. of from 1·14 to 1·13, and it is next treated with sulphuretted hydrogen gas until it smells strongly of the gas. The liquid is next filtered, and then poured into a tabulated retort and heated until the sulphuretted hydrogen is eliminated. The test of solution of corrosive sublimate having been applied, the bulk of the acid is distilled over at a gentle heat, a few fluid ounces only being left in the retort, so that any chloride of iron left in the acid may be retained.

Quantity of Starch contained in Different Varieties of Potatoes.—Dr. Raab.—The tabulated form containing the record of experiments with sixty-one different varieties of potatoes, in which the author has estimated the total percentage of dry substance and the total quantity of starch. It appears from this research that the percentages alluded to vary, for dry matter, from 15·64 to 34·25, and the percentage of starch from 8·79 to 26·09.

Mejillones Guano.—H. Vohl.—This material occurs native and in large quantity near the Bay of Mejillones (Bolivia). In 100 parts, this substance consists of—Lime, 30·6636; magnesia, 7·9193; peroxide of iron, 0·1466; alumina, 0·0047; potassa, 0·5051; soda, 1·4532; phosphoric acid, 35·86803; chlorine, 2·2250; sulphuric acid, 1·6036; silica, 0·0459; carbonic acid, 1·5926; water driven off at 100°, 7·6858; non-nitrogenous organic matter, 6·5189; nitrogen, 0·7675; granules of granite insoluble in HCl, 2·2830; loss, 0·7249. The author states that this guano occurs in pulverulent sandy state, and that it is readily acted upon by carbonic acid and water, and thus rendered available for plants, while, in consequence of its high percentage of phosphoric acid, it may be used with advantage for the preparation of phosphate of ammonia and other phosphatic preparations.

May and June (double number), 1872.

This number contains no original matter relating to chemistry.

The American Journal of Science and Arts, October, 1872.

This number only contains one original paper relating to chemistry:—

Results of a Chemical Investigation of some Points in the Manufacture of Malleable Iron.—Russell W. Davenport.—Reserved for full reproduction.

This number contains several important papers relating to natural history, geology, astronomy, and physiology.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, June, 1872.

On Hypophosphites.—C. Rammelsberg.—This monograph has been already alluded to (see CHEMICAL NEWS, vol. xxvi., p. 23).

Behaviour of the Diamond and of Graphite when Strongly Heated.—G. Rose.—This essay, illustrated by several engravings, is divided into the following sections:—Ignition of diamond without access of air; ignition of diamond with access of air; on the peculiar and regular impressions which are formed on the diamond during its combustion; on the so-called carbonado (a peculiar variety of diamond found in Bahia); behaviour of graphite when ignited.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, June 27, 1872.

We receive this periodical very irregularly, this number having only just arrived.

Preparation of Sugar Colour from Glucose.—M. Krothe.—The detailed description of the industrial method of converting glucose into caramel, simply carried on by heating the glucose, which is largely made abroad by the action of sulphuric acid upon starch in boiling-water, with the addition of a small quantity of carbonate of ammonia, the materials being well stirred and carbonisation prevented. This kind of caramel is largely used to give a fictitious strength to beer.

Industrial Preparation of Hydrogen.—M. Giffard.—By first reducing to the metallic state a peculiar kind of iron ore found at Chateauroux (France) by means of oxide of carbon, finely-divided iron is obtained, which is used to prepare hydrogen, which thus costs only ½d. per cubic metre (35·31 English cubic feet) and may be used for various heating, illuminating, and air-balloon filling purposes.

Applications of Sulphurous Acid Gas.—M. Chaudet.—The author proposes to apply sulphurous acid gas—obtained in the usual way from pyrites or burning sulphur—for the purposes of saturating urine, the contents of *fosses d'aisance*, ammoniacal gas-water, the waste soap-water from woollen and other industries, partly for disinfection, but more particularly for obtaining valuable products by evaporation; the sulphurous acid gas is forced into the liquids by means of blowing-vans or force-pumps.

Note on the Determination of the True Zero of Thermometers.—Ch. Tellier.—Reserved for full translation.

American Journal of Pharmacy, October, 1872.

This number contains the following original papers relating to chemistry:—

Soluble Sulphate of Quinine.—J. Donde.—150 grms. of the ordinary sulphate of quinine are taken, and gradually put into a mixture of 22 grms. of concentrated sulphuric acid and 2 litres of water; this mixture is occasionally agitated until solution has taken place, and, after filtering, the fluid is concentrated by evaporation until the liquor is reduced to 600 grms.; the crystals are taken out twenty-four hours afterwards, and the remaining mother-liquor is again evaporated in order to obtain more crystals.

Preparation of the Bromides of Quinine, Morphine, Strychnine, and Calcium.—G. Macdonald.—The bromides of the alkaloids may be readily prepared on the small scale by precipitating the solutions of their neutral sulphates with bromide of barium, the latter to be prepared by saturating hydrobromic acid with carbonate of baryta; the bromide is very soluble, and it is not necessary to crystallise the solution. The bromides of the above-named alkaloids may be prepared for pharmaceutical purposes by a similar method. As regards bromide of calcium, the author directs to prepare it by double decomposition, aided by boiling a solution of bromide of ammonium, to which milk of lime (the lime to be made from pure white marble) is added, until ammoniacal vapours cease to be evolved; the salt is very deliquescent and requires to be kept in well-stoppered bottles.

Occurrence of Amygdalin, and Generation of Hydrocyanic Acid.—S. Henschen.—The author instituted a number of experiments by which he proved the presence of hydrocyanic acid by means of paper dipped in tincture of guaiacum and a solution of sulphate of copper, carefully avoiding ammoniacal vapours. Amygdalin treated with the meal of peas and of rye yielded hydrocyanic acid, but none with sifted wheat-flour. Sweet almonds were found to contain a minute quantity of amygdalin. The seeds of apples, pears, quinces, *Sorbus aucuparia*, *Sorbus latifolia*, all yielded HCy; traces of that acid were obtained from vetches. The generation of HCy from vegetables is generally regarded as conclusive evidence of the presence therein of amygdalin, but Dr. Peckolt ("Analyses de Materia Medica Brasiliera," Rio Janeiro, 1868) was unable in fifteen cases to prepare amygdalin from the root of the *Manihot utilissima* (the arrow-root plant) which copiously generates hydrocyanic acid with water. Vetches yield, instead of amygdalin, a new crystallisable body, $C_8H_{18}N_4O_8$. It would appear from some of the author's experiments that amygdalin may occur in plants without the simultaneous presence of emulsin; to ascertain the presence of amygdalin, the vegetable material is finely powdered, the acid which may be present is neutralised by chalk, some coarse rye-meal or a similar ferment is added, and then some water, after which the fermentation is allowed to proceed, and the presence or absence of HCy established as mentioned above.

Manufacture of Olive Oil in California.—Dr. J. M. Maisch.—It appears from the contents of this essay that the cultivation of the olive tree is very successful, and that the preparation of olive oil is becoming a leading industry in California.

Cotton-Seed Oil.—Dr. J. M. Maisch.—The preparation of this oil is carried on to a very large extent in some parts of the United States, 150,000 tons of seed being used annually; the oil-cake is largely exported to England, and the oil goes mostly to Bordeaux, Barcelona, and other olive-growing parts of Europe, from whence, after refining, it comes back as pure olive oil; a large proportion of raw cotton-seed oil is refined in London, and thence exported.

Les Mondes, October 24, 1872.

Obituary.—We learn with regret the demise of the celebrated physicist Jaques Babinet, who died on October 21, aged seventy-eight, having been born at Lusignan on March 5, 1794. The deceased *savant* was well and deservedly known as an excellent mathematician and physicist.

Deposits of Phosphatic Minerals at the Locality Known as the Perte du Rhone.—L. Grasser.—In a letter addressed to MM. Lomer and Ellershausen, at Geneva, the author, who is an inspector of mines, gives a detailed account of several deposits of phosphatic minerals met with on and near the spot where the river Rhone enters French territory. The mineral, both mineralogically and palæontologically, differs from coprolites and phosphatic nodules, consisting, in fact, of shells, the interior of which is filled with phosphate of lime. A sample found at Lancrans gave on analysis, in 100 parts—Phosphate

of lime, 70·6; carbonate of lime, 15·0; insoluble matter, 12·0; bituminous matter and water, 2·4. A fragment from a nautilus from Mussel, gave, in 100 parts—Phosphate of lime, 65·3; carbonate of lime, 26·0; insoluble matter, 5·0; bituminous matter and water, 3·7. According to careful surveys, the total quantity of phosphatic mineral in this district amounts to 8,800,000 tons.

Although not strictly belonging to chemistry, we call attention to the following paper:—

Apiculture, a Method of Treating Bees for the Purpose of Safely Extracting the Honey and Wax from the Hives.—V. Meunier.—The author describes at length a process of administering chloroform to bees.

Absorbent Power of Phosphorus.—F. Sestini.—The author observes that when iodide of ethyl is made by Dr. Frankland's or Dr. Kopp's process there is left a solid brown-red to orange-brown residue, which is found to be amorphous phosphorus. The author says that this substance retains several metalloids, but especially iodine, even after having been repeatedly treated with boiling ether and then with a boiling solution of caustic potassa, while phosphuretted hydrogen is given off. There is left in the liquid much iodine; one sample was found to contain as much as 3·369 per cent. It appears, also, that the amorphous phosphorus (the residue from the preparation of iodide of ethyl) retains sulphur after having been treated with sulphide of carbon for the purpose of eliminating the ordinary white phosphorus; this sulphur is due to an incipient decomposition of the sulphide when in contact with the amorphous phosphorus at a higher temperature. According to the author, phosphorus exerts this absorbent power either by porosity (surface attraction) similar to that of charcoal and bone-black, or in the same manner as benzoic acid is retained by benzoin resin when the latter is used by the well-known process for the preparation of that acid.

Passivity of Cadmium.—M. Schoenck.—When cadmium is immersed in strong nitric acid (sp. gr., 1·47) it is readily dissolved, but when a spiral of platinum wire is tightly wound round the cadmium the latter is not acted upon by the nitric acid unless the acid is diluted with water.

International Congress for Weights and Measures.—M. Tresca.—The International metre will be constructed (viz., the standards) of an alloy of 90 parts of platinum and 10 of iridium, with a toleration of 2 per cent *plus* or *minus*; these standards will be verified at 0°, and copied exactly from the standards deposited in the Archives of the French Academy. The standard kilo. will be made of the same material, and also copied exactly from the standard deposited in the Archives of the Academy. The execution of the standards is entrusted to the French members, assisted by a permanent committee elected from the foreign members of the Congress; this committee will be composed of twelve members, five being a quorum. The members of the Congress have agreed to state to their respective Governments that it is desirable to establish a permanent International Bureau for Weights and Measures at Paris.

Polytechnisches Journal von Dr. E. M. Dingler, second number for September, 1872.

This number contains following original papers and memoirs relating to chemistry and collateral subjects:—

Improved Construction of Prony's Dynamometer.—C. Wersin.—The detailed description, illustrated by engravings, of an improved contrivance for ascertaining the dynamic force of machinery.

Peculiar Boiler Deposit Formed in the Steam-Space of a Boiler.—E. Mategczek.—The author relates a peculiar formation of a boiler deposit in the space not filled with water, but with steam. The sp. gr. of this material was found to be 1·388, and its chemical composition, in 100 parts, as follows:—Water, 2·831; fatty matter, 1·430; organic matter, 21·995; silica, 21·713; sulphuric acid, 6·947; chlorine, 0·139; oxide of iron, 3·836; phosphoric acid and alumina, 7·878; lime, 15·752; magnesia, 4·151; sand and clay, 12·283. The water used as feed-water for this boiler was taken from the river Elbe, but the large proportion of organic matter is in a measure due to the fact that the feed-water is taken from the condensed hot water from the air-pumps, the boiler being used in a beet-root sugar-works and refinery.

Estimation of Oxygen in the Decarbonised Bessemer Metal before the addition thereto of the Specular Iron, on the Action of that Iron and a Substitute for it, and the Means of Producing a Bessemer Casting without being Honeycombed.—Dr. A. Bender.—An essay strictly treating on the practice of sidero-metallurgy.

Journal für Gasbeleuchtung und Wasserversorgung, No. 18, 1872.

This number only contains matter relating to gas- and water-works' engineering and management.

NOTES AND QUERIES.

Transparent Cement.—(Reply to "Omicra."—You will find the information in the English edition of Wagner's "Chemical Technology," recently published by Messrs. J. and A. Churchill.

Oxychloride of Magnesium Cement.—Will any correspondent who has made this cement oblige by publishing the process; I have never been able to make it satisfactorily, nor have I met with anyone who has used it with success. The fact of its existence has been published so often as to leave no doubt of the possibility of making it. —T. F.

Sugar Refining—Works on Organic Chemistry.—(Reply to A. J. W.)—Consult "Traité Complet Théorique et Pratique de la Fabrication du Sucre Guide du Fabricant," par Charles Stammer (Paris: E. Lacroix). Among the large number of excellent works on organic chemistry published in different languages, we mention "Ausführliches Lehrbuch der Organischen Chemie," von Dr. H. Kolbe (3 vols.). These works may be inspected at the Patent Office Library. "Chemisch-Technische Mittheilungen," by Dr. Elsner; annually; 19 vols. published. "Jahresberichte über die Liestungen der Chemischen Technologie," by Dr. Wagner; 17 vols.; published annually. "Index to Foreign Scientific Periodicals contained in the Free Public Library of the Commissioners of Patents" (7 vols.).

PATENTS.

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GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2476. A. Deiss, Plaistow, Essex, "A new or improved process of percolation for the purpose of extracting fatty, resinous, and similar matters."—Petition recorded August 20, 1872.

2712. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in effecting the purification of cast-iron, malleable iron, cast-steel, and malleable steel, and other metals or alloys."—A communication from J. B. L. Forquignon, Nancy, and L. M. Ehrmann, Paris, France.—Petition recorded September 12, 1872.

2746. E. T. Hughes, Chancery Lane, Middlesex, "The treatment of greasy and washing liquors used in scouring or cleaning wool by caustic baryta or strontia."—A communication from L. G. G. Daudenart, and E. Verbert, Rue du Progrès, Schaerbeck, Brussels.—Petition recorded September 16, 1872.

2822. C. Morfit, Baltimore, U.S.A., "Improvements in the reclamation of materials employed in the manufacture of di-phosphate and tri-phosphate of lime."—Petition recorded September 24, 1872.

2913. H. B. Barnett and W. B. M. Slade, Gracechurch Street, London, "Improvements in the preparation or production of disinfecting, antiseptic, and cleansing liquids."—Petition recorded October 3, 1872.

2930. J. G. N. Alleyne, Alfreton, Derbyshire, "Improvements in apparatus for the manufacture and refining of sugar and rum, or other spirit."

2934. H. B. Barnett and W. B. M. Slade, Gracechurch Street, London, "Improved manufacture of fluids for deodorising and disinfecting purposes."—Petitions recorded October 4, 1872.

2941. G. Robbe, Fenchurch Street, London, "A medical preparation applicable to the treatment of what is known as 'Foot and mouth disease' in cattle."—A communication from J. M. Brunet, Dieppe, France.

2943. E. J. Payne, Páckwood, Warwickshire, and W. Clarke, Dudley, Worcestershire, "Improvements in converting or partially converting iron into steel."—Petitions recorded October 5, 1872.

2947. J. Macintosh, Bayswater, and W. Boggett, Chelsea, Middlesex, "Improvements in treating and applying animal membranes, and in constructing articles therewith, comprising vessels to contain air, and in valves for inflating the same, which valves are applicable to other useful purposes."—Petition recorded October 7, 1872.

2959. W. Lorberg, North Bow, Middlesex, "A new or improved process for the manufacture of soap."

2964. H. Lonkin, Theydon-Gernon, Essex, A. Leighton, South Castle Street, Liverpool, and W. White, Thurlow Road, Hampstead, Middlesex, "Improvements in the production of iron and steel."—Petitions recorded October 8, 1872.

2974. B. Tanner, Liverpool, "Improvements in the manufacture of artificial manures."—Petition recorded October 9, 1872.

2982. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in the manufacture of alkalies, and in apparatus employed therein."

2989. J. Young, Kelly, Renfrewshire, N.B., "Improvements in the manufacture of carbonate of soda."

2995. J. H. Dickson, Harefield, Middlesex, "An improved process of and machinery for treating or preparing fibre-yielding plants for the purpose of obtaining useful fibres therefrom."—Petitions recorded October 10, 1872.

2997. J. W. Perkins, Brixton, Surrey, "The manufacture of artificial fuel."

3003. J. Steedman, Glasgow, N.B., "Improvements in obtaining acetic acid."

3005. C. Lowe, Reddish, Lancashire, "Improvements in the treatment of coal-gas tars for the purpose of obtaining certain useful products therefrom."

3007. E. C. Nicholson, Kennington Road, Surrey, "Improvements in the separation of substances and products capable of being employed for the purposes of dyeing and printing."—Petitions recorded October 11, 1872.

3040. P. Maccallum, Dunfermline, N.B., "A new or improved artificial fuel."—Petition recorded October 15, 1872.

NOTICES TO PROCEED.

1722. T. Gray, New Wandsworth, Surrey, "Improvements in the means of treating vegetable fibres for the manufacture of paper."—Petition recorded June 7, 1872.

1723. J. J. Harrop, Manchester, and W. Corbett, Bradford, Lancashire, "Improvements in puddling iron and in puddling furnaces."—Petition recorded June 7, 1872.

1742. C. A. Faure, Brook Street, Lambeth, Surrey, "Improvements in the process or processes of applying electric currents to chemical decompositions and combinations, including the manufacture of alkalies."—Petition recorded June 10, 1872.

1743. O. Doyen, Reims, France, "An improved preparation and utilisation of coffee in the form of tablets for food."—Petition recorded June 10, 1872.

1769. J. Dupont, Nimes, France, "The application and treatment of certain plants not hitherto used for the production of filaments and fibres."—Petition recorded June 12, 1872.

2144. S. S. Bateson, Bolton Street, Mayfair, Middlesex, "Improvements in the treatment of hides or skins."—Petition recorded July 17, 1872.

2712. J. H. Johnson, Lincoln's Inn Fields, Middlesex. "Improvements in effecting the purification of cast-iron, malleable iron, cast-steel, and malleable steel, and other metals or alloys."—A communication from J. B. L. Forquignon, Nancy, and L. M. Ehrmann, Paris, France.—Petition recorded September 12, 1872.

2790. R. Stone, Liverpool, "An improved artificial fuel."—Petition recorded September 20, 1872.

2845. F. Walton, Staines, Middlesex, "Improvements in oxidising oil, and in machinery to be employed for that purpose."

2847. C. W. Harrison and A. H. Harrison, High Holborn, Middlesex, "Improvements in combining atmospheric air and certain gases for lighting and heating purposes."—Petitions recorded September 26, 1872.

2861. C. W. Siemens, Great George Street, Westminster, "Improvements in the process for the production of iron and steel, and in furnaces or apparatus employed for that purpose."—Petition recorded September 28, 1872.

2950. T. Greener, Darlington, and W. Ellis, Gateshead, Durham, "Improvements in the manufacture of iron and in the production of 'fetling' for improving the quality and yield of iron in the process of reduction."—Petition recorded October 7, 1872.

2964. H. Larkin, Theydon Gernon, Essex, A. Leighton, South Castle Street, Liverpool, and W. White, Thurlow Road, Hampstead, "Improvements in the production of iron and steel."—Petition recorded October 8, 1872.

PATENTS SEALED.

1171. J. Barrow and C. J. Crosfield, Liverpool, "Improvements in utilising certain saccharine syrups, and in apparatus employed therein."—Dated April 19, 1872.

1264. W. A. Lyttle, Hammersmith, Middlesex, "Improvements in the preparation and utilisation of bituminous asphalte."—Dated April 27, 1872.

1293. C. Duff, Wandsworth Road, Surrey, "Improvements in the treatment of fibrous substances to be used in the manufacture of pulp for paper, and for conversion into spun and textile fabrics."—Dated April 30, 1872.

1307. L. Bradley, Rotterdam, Holland, "Improvements in the manufacture of cement."—Dated May 1, 1872.

1468. J. Spratt, Camberwell, Surrey, "A new or improved food for cats."—Dated May 14, 1872.

1476. R. C. Menzies, Valleyfield, Midlothian, N.B., and A. E. Davies, Worcester, "Improvements in the manufacture of pulp for paper-making."—Dated May 15, 1872.

1802. C. W. Smith, Highfield, near Stroud, Gloucestershire, "Improvements in the extraction of indigo and other similar substances from plants containing such substances.—Dated June 15, 1872.

2572. W. R. Lake, Southampton Buildings, London, "Improved compounds, chiefly designed for coating ships' bottoms."—A communication from J. H. Bloodgood, New York, U.S.A.—Dated August 29, 1872.

FOREIGN PATENTS.

ITALY.

1. L. Pasteur, "A new process for the manufacture of beer."—Dated September 4, 1871.

3. J. V. P. Lagrange, "Purifying and clarifying sugar-juice and syrup in sugar works.—Dated December 11, 1871.

4. E. Leconte, "Using starch of maize, rice, &c., in the manufacture of beer, alcohol, and other fermented liquors."—Dated January 2, 1872.

10. J. Bertram and Son, "Improvements in the manufacture of pulp of straw and other like fibrous substances, and in apparatus belonging thereto."—Dated March 26, 1872.

13. A. Ungerer, "A chemical process for obtaining wood pulp."—Dated February 17, 1872.

16. J. B. Muschamp, "Improvements in explosive substances, and process for manufacturing the same."—Dated March 29, 1872.

18. F. Terrachini, "Extracting sulphuretted hydrogen from the sulphur ores of Sicily."—Dated March 30, 1872.

PRUSSIA.

7. H. Jüngling, "An apparatus for manufacturing gas."—Dated August 26, 1872.

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Seventh Report of the Quekett Microscopical Club, and List of Members.
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THE CHEMICAL NEWS.

Vol. XXVI. No. 676.

DESCRIPTION OF A NEW QUINIMETRIC PROCESS.*

By P. CARLES.

Having ascertained, by experiment, that the quinimetric methods in use are not suited for extracting, in a sufficiently pure state to admit of weighing, all the quinine contained in the cinchona barks (the decoction method extracts colouring matter and changes the active principles, while the lixiviation process yields very weak liquors, in which a portion of the alkaloids are kept in solution), I have devised a method which may be carried out as follows:—A good average sample of the bark is ground to powder, and passed through a fine horse-hair sieve; 20 grms. of this powder are intimately mixed with from 6 to 8 grms. of slaked lime, mixed with 35 grms. of water, and the mixture of quina bark and pasty lime dried at a gentle heat; the cake thus formed is reduced to a coarse powder and pressed into a conically-shaped glass tube (or a funnel with stop-cock and glass stopper); chloroform is then gradually poured on to the contents, care being taken to cork the tube at the top: 150 grms. of chloroform will be a sufficient quantity, but it is best to ascertain if the bark is exhausted by evaporating a few drops of the last portion of the chloroform in a porcelain basin; the residue should be treated first with dilute sulphuric acid, and next with chlorine water and ammonia. The chloroform which adheres to the mixture of lime and bark is displaced by the addition of water, and the fluid is next evaporated upon a water-bath until a dry residue is left. If desired to save the chloroform, it can be distilled off in a retort upon a water-bath: the distillation should not, however, be carried on to dryness, but the remainder of the fluid is to be evaporated to dryness in a porcelain capsule, and then treated with dilute sulphuric acid. The solid dry residue consists of the alkaloids of the bark, mixed with about their own weight of waxy-resinous (*céréo-resineux*) matters; the alkaloids are taken up by dilute sulphuric acid (1 to 10), of which fluid from 10 to 12 c.c. are sufficient. This solution is filtered through a very small, previously moistened, filter, and the filtrate is colourless; the filtrate is next heated to 100° upon a water-bath, and, when hot, ammonia—at first concentrated, afterwards dilute—is added, so as to cause the filtrate to become very nearly saturated,—to be left very slightly acid; all the quinine will then crystallise in the shape of sulphate. This crystallisation proceeds rapidly, and the peculiar odour emitted by the fluid, as well as the aspect of the crystals, are of some value in ascertaining beforehand the quality of the bark operated upon. When the liquid has become completely cold the crystalline matter forms a solid cake, which has only to be placed upon a double filter for the purpose of draining; the mother-liquor is displaced by a few drops of water, after which the mass is gently pressed, dried, and weighed.* If the mother-liquor is found to be very acid, ammonia in slight excess should be added, for the purpose of precipitating the rest of the quinine. The other alkaloids remain in solution, and are next separated by precipitation, dried, weighed, and tested with washed ether.

This process is simple and expeditious, and yields good results, the quinine being obtained in a colourless state. I quote the following instances of its working:—(1). A mixture was taken of pure sulphate of quinine, 0·60; cinchonine, 0·20; dilute sulphuric acid (1 to 10), 10 c.c.; while hot I poured, by means of a pipette, first concentrated and then dilute ammonia nearly to saturation: result obtained—sulphate of quinine, 0·59; cinchonine, 0·22. (2). Sulphate of quinine, 0·50; cinchonine, 0·25: acid at $\frac{1}{10}$, 10 c.c., found sulphate of quinine, 0·52; cinchonine, 0·17. A. Yellow cinchona bark, 20 grms. has yielded per 1000, by the use of Rabourdin's modified process (see *Journ. de Pharmacie*, 1861), strongly-coloured crystalline sulphate of quinine, 23·00; with Le Maitre's process, somewhat yellow-coloured sulphate of quinine, 22·30; with my process, colourless sulphate of quinine, 26·55. B. Yellow cinchona bark, same quantity, by Rabourdin's process, strongly coloured crystallised sulphate of quinine (per 1000), 29·50; Le Maitre's process, yellow-coloured sulphate, 26·75; my process, colourless sulphate, 31·25. Trials with other kinds of bark yielded similar results, but I should mention that the separation of the quinine as sulphate only succeeds well when the quantity of quinine in the bark greatly exceeds the cinchonine.

To exhibit the effect of an excess of cinchonine I quote the following:—Sulphate of quinine, 0·40; cinchonine, 0·60; acid $\frac{1}{10}$, 10 c.c., yielded—sulphate of quinine, 0·58 (mixed with cinchonine); cinchonine, 0·48: the impure sulphate of quinine thus obtained may be purified, recrystallised, and tested with ether and ammonia.

As sulphate of quinine is completely insoluble in a solution of sulphate of ammonia, there is no fear of any of the sulphate of quinine being left in the mother-liquor if the saturation with ammonia is sufficiently complete. To prove this experimentally, take a small quantity of sulphate of quinine, shake it up in a test-tube three parts filled with cold distilled water, filter, and add to the filtrate a few crystals of sulphate of ammonia. After a few minutes the liquid will become a pasty mass: this is filtered, and not a trace of sulphate of quinine is found in the filtrate.

* *Bulletin de la Societe Chimique de Paris.*

† It is preferable to dry at 100°, and, after having weighed, to add the 12 per cent of water lost by the operation: in that condition it contains 75 per cent quinine.

ON SLOW COMBUSTION.

By P. J. Van KERCKHOFF, Ph.D., &c.,
Professor of Chemistry at the University of Groningen, Netherlands.

A large number of substances possess the property of combining, in a shorter or longer period of time, according to the prevailing conditions, with oxygen, and form therewith oxidised compounds. In many instances this slow or rapid oxidation depends (all other conditions remaining unaltered) upon the temperature, but it is not the only factor. To the large number of conditions which influence oxidation belongs the presence of a substance which is found unaltered after the action is finished; this substance may or may not have undergone any action at all. Many of these actions, formerly known as action of contact, or catalytic action, have become better known by deeper investigation; it has been ascertained that they could be reduced, either to ordinary chemical actions, in which the active substance became alternately metamorphosed and reproduced, or to modifications of physical conditions implying generally a change of temperature. To the alternate fixation and giving off of oxygen belongs, for instance, the action of deutoxide of nitrogen and of ferric oxide; to the second, the remarkable property of platinum, first discovered by Sir Humphrey Davy, to determine chemical combinations in general, and consequently also oxidations, while the platinum itself is not chemically altered. This property of platinum has led to experiments with other substances, many of which were found to act in a manner similar to platinum. The researches of Döbereiner, Pleischl, Dulong, Thénard, Cloez, and others have brought to light a great many facts relating to this subject. As, however, the conditions which play a part in the

phenomenon alluded to, and the influence of which ought to be known, have not all been thoroughly taken into account, it appeared to me that the study of some of them would not be useless. I have limited my investigation to the action of oxygen upon a couple of combustible gases—viz., (1) on a pure (unmixed) gas, oxide of carbon; and (2) on the mixture of gases constituting ordinary illuminating gas, care having been first taken to completely eliminate all the carbonic acid. The following principal points were investigated :—

(1). What degree of influence is exerted by the time of duration of the contact between the combustible gas and oxygen, in the presence of chemically passive matter.

(2). Whether this duration varies according to the nature of the solid matter.

(3). Whether, for different gas mixtures, the slow combustion requires a different temperature.

(4). Whether the carbonic acid, which must be generated in the case of oxidation, is evolved in the state of gas, or remains condensed in the porous matter.

(5). Lastly, among the solid substances in the presence of which the combustion can proceed, I have chosen one which hitherto has scarcely been investigated, and could be used in pure state without carrying over oxygen to the combustible substance.

My first experiments were so arranged that a mixture of oxygen and combustible gas, each of these being previously freed from any trace of carbonic acid, was slowly passed through a U-shaped tube containing the solid material to the influence of which it was desired to submit the gaseous mixture. The gas, after having passed through the U-shaped tube, was conveyed through clear lime-water. The U-tube could be placed, if required, in a water-bath, so as to keep up any degree of temperature desired. The oxygen, prepared from chlorate of potassa and collected in a gas-holder over pure water, was in every experiment passed through a tube containing soda-lime, in order to eliminate any carbonic acid or chlorine with which it might accidentally be contaminated; then it was passed through a large bottle containing lime-water. The same precautions were taken with the oxide of carbon, prepared by the action of sulphuric acid upon oxalic acid, the gas being thoroughly washed through milk of lime previous to being conveyed to the gas-holder, the tank of which was also filled with thin milk of lime. The ordinary illuminating gas, which nearly always contains traces of carbonic acid, was, of course, purified. In all the experiments, the gas, on being tested previous to its passage through the U-tube, was found to be free from carbonic acid.

The solid substances employed in these experiments are—(1) platinised asbestos previously ignited; (2) pumice stone, first repeatedly boiled in dilute hydrochloric acid, next well washed, and lastly ignited; (3) pipe-clay treated in the same way. Repeated experiments taught that, between temperatures varying from 5° to 15°, platinised asbestos was the only one of the three substances which caused the oxidation of the oxide of carbon. The mixture caused, after having passed the asbestos, in a relatively short time, a precipitate in the bottle containing lime-water; but in the case of pumice-stone and pipe-clay not the slightest turbidity was observed. This result with the platinised asbestos could be readily foreseen, as it is well-known that spongy platinum even causes the deflagration of a mixture of oxide of carbon and oxygen, especially when these two gases are mixed in the proportion of 2 vols. of CO for 1 vol. of O. By the use of platinised asbestos the action is slackened sufficiently by the state of division of the platinum between the fibres, that no explosion of the gases takes place. When a mixture of 1 vol. of illuminating gas and 2 vols. of oxygen were caused to pass, at a temperature of from 5° to 15°, through the U-tube filled with platinised asbestos, not a trace of carbonic acid was formed. Similar experiments were made with pumice-stone and pipe-clay, first at a temperature of from 50° to 60°, next at between 80° and 90°, but in neither of these operations was any carbonic acid formed, As an instance of the mode of operating and experimenting, I quote the following description of an experiment :—

Coal-gas and oxygen, both quite free from carbonic acid, were mixed in the proportion of 1 vol. of the first and 2 vols. of the second, and passed through a U-shaped tube of about 10 c.c. capacity, filled with 5 grms. of purified pipe-clay; the tube was placed in a water-bath kept at a temperature of from 50° to 60°. The velocity of the current of the gas was so regulated that the outlet-tube, having an internal diameter of 5 m.m., passed four bubbles of gas per second, while the operation was kept going on for half an hour; neither during this time, nor after it, was the slightest turbidity caused in the lime-water, through which the gas was passed when leaving the outlet-tube.

Judging from the results of experiments to be presently mentioned in detail, it might be suspected that a small quantity of carbonic acid, which might have been formed at the temperature alluded to, could have been retained in the U-shaped tube by the pipe-clay. In order to ascertain this, the gaseous mixture retained in the tube was first expelled by a current of air previously freed from carbonic acid at the ordinary temperature, and the tube next heated up to nearly 100°, while the current of air was kept up. Even after this operation the lime-water remained perfectly clear.

In the second series of experiments, made with the same mixture of combustible gas and oxygen, the duration of the contact with the solid substance has been much prolonged, and consequently the arrangement of the apparatus was different. The gases intended to be experimented with were mixed and measured in the proportion of 2 vols. of CO and 1 vol. of O, or of 1 vol. of coal-gas and 2 vols. of O, in a glass bell-jar fitted with a stop-cock, and placed over lime-water; by forcing the bell-jar down into this fluid the gas could be forced out of it. This gas mixture was next made to pass through a tube filled with soda-lime, and next through a bottle containing lime-water, which, in order to make the experiment reliable, ought to remain quite clear, and this was so in all the experiments recorded. A glass vessel of about 600 c.c. capacity, and fitted with two necks, is filled with the gas mixture, care being taken to cause the gas to pass for some time slowly through the vessel for the purpose of eliminating the air it contains. Into each of the necks is tightly fitted a cork, which is varnished, and into each of which a short glass tube is fitted tight; a stout vulcanised india-rubber tube is tied to each of them. By means of a spring-clip these tubes can be closed if desired.

The balloon-shaped glass vessel, into which some 5 to 6 grms. of the solid substance (after being ignited) to be experimented with has previously been placed, having been well filled with gas, and the inlet- and outlet-tubes closed, could be kept at the desired temperature without any chance of atmospheric air being introduced into it, as proved by the negative results of several of the undermentioned experiments. To ascertain, at the end of the experiment, whether oxidation had or had not taken place, the contents of the balloon were tested as follows :—One of the caoutchouc tubes fastened to the neck of the balloon was connected with a test-bottle filled with lime-water, to which was further connected a tube filled with soda-lime, through which the atmospheric air, intended for the purpose of displacing the gas contained in the balloon, had to pass. To the other caoutchouc tube was fastened a glass tube, destined to carry off the gas from the balloon into lime-water, contained in a double-necked bottle and connected with an aspirator. In this manner, it was possible to regulate at will the rapidity of the current of the air from the balloon into the lime-water. Although there could be no doubt that platinised asbestos would, in this mode of experimenting, just as in that above referred to, cause oxidation, we have again tried it, and pumice-stone and pipe-clay have also been used. Each of the following experiments has been repeated, always with the same results :—

Experiments made with Oxide of Carbon.

Temperature, 0° to 10°. Duration of experiment, 16 days.

Lime-water.

Platinised asbestos	Yields a turbidity after the passing of a few bubbles of gas, and afterwards an abundant precipitate.
Pumice-stone ..	Remains quite clear.
Pipe-clay	Remains quite clear.

Temperature, 5° to 15°. Duration of experiment, 16 days.

Lime-water.

By passing the gas of the balloon into it without application of heat—	By passing air into the balloon after the gas has been eliminated, the solid substance being simultaneously heated—
Pumice-stone { Remains quite clear. }	Remains quite clear.
Pipe-clay..Remains quite clear.	Remains quite clear.

Temperature, 50° to 60°. Duration of experiment, 9 hours.

Lime-water.

The gas being passed into it without the contents of the balloon having been heated to a higher degree.

Pumice-stone ..	Soon gives a precipitate, which in a short time becomes considerable.
Pipe-clay	Remains quite clear.

Temperature, 64° to 65°. Duration of experiment, 16 hours.

Lime-water.

By passing the gas from the balloon into it without further heating the contents—	By passing air through the balloon after the gas has been withdrawn from it, and simultaneously heating of the solid substance—
Pipe-clay { Remains perfectly clear.	Causes soon a turbidity, which increases after a short time.

Temperature, 80° to 90°. Duration of experiment, 12 hours.

Lime-water.

By passing the gas from the balloon into it without further heating the contents—	By passing air through the balloon after the gas has been withdrawn from it, and simultaneously heating the solid substance—
Pipe-clay { Remains perfectly clear.	Becomes rapidly and rather strongly turbid.

Experiments with Coal-Gas.

Temperature, 5° to 15°. Duration of experiment, 9 days.

Lime-water.

By passing the gas from the balloon into it without further heating of the contents—

Pumice-stone ..	Remains clear.
Pipe-clay	Causes a perceptible turbidity.

Temperature, 80° to 90°. Duration of experiment, 11½ hours.

Lime-water.

By passing the contents of the balloon into it without further heating the contents—	By passing air through the balloon after the gas has been withdrawn from it, and simultaneously heating the solid substance—
Pumice-stone— Causes a perceptible turbidity.	Becomes strongly turbid and gives a precipitate.
Pipe-clay— Becomes immediately turbid and gives a precipitate.	Not examined.

As regards the experiments with platinised asbestos, I have only to observe that, under its influence, which becomes apparent at the ordinary temperature, coal-gas is burnt less easily than oxide of carbon by oxygen; and it appears that, in the first place, the small quantity of oxide of carbon, contained to an amount of from 7 to 9 per cent in coal-gas, is first oxidised. Leaving out of the question the action of the platinised asbestos, the following conclusions can be drawn:—

(1). That at the ordinary temperature a pumice-stone and pipe-clay cannot, when the time of action is short, cause the oxidation of oxide of carbon, nor of coal-gas when mixed with pure oxygen.

(2). That a contact of brief duration does not produce any perceptible oxidation at temperatures of from 50° to 60°, and even at from 80° to 90°.

(3). That, while the combustion of these two gases is not perceptible when the experiment lasts only a short time, it becomes very perceptible when the experiment is continued for some length of time; it is, therefore, not improbable that, when the experiments were continued for a long time, oxidation would be ascertained to take place where during sixteen days no formation of carbonic acid occurred.

(4). That oxidation or combustion, resulting in the formation of carbonic acid, requires the longer time when the temperature is low.

(5). That there exists a difference between the temperatures at which pumice-stone and pipe-clay begin to exert an influence upon the oxidation of oxide of carbon, pumice-stone becoming active earlier than pipe-clay when the temperature increases.

(6). That, as regards coal-gas, an inverse relation is observed, because pipe-clay already manifests activity at a temperature at which pumice-stone, left in contact with the gas mixture for the same time, does not give rise to oxidation.

(7). That the carbonic acid gas which is formed does not always make its appearance at once as a gas in free state, but may remain entirely occluded in the pores of the solid substance when the quantity of gas operated with is small.

(8). That pipe-clay retains the carbonic acid gas which is formed far more readily than pumice-stone, while the former also only gives it off at a higher temperature.—*Archives Neerlandaises des Sciences Exactes et Naturelles.*

NOTE ON CHLORAL.

By EDWARD R. SQUIBB, M.D.

CHLORAL supplies another forcible illustration of the baneful effects of speculation and inflation, and of the dangers which must always attend popularity, and particularly the popularity of potent medicinal agents. It seems hard to teach the public that nothing can be potent only for good. That to be potent for good involves, in the very nature of all things, an equal potency for harm. Hence the danger of advertising any medical substances which have any potency for popular use. The multitude of mere placebos, and catch-penny quackeries, which serve at the same time to make money and give mental occupation and relief to trifling or imaginary ills, may be puffed and inflated for popular use with comparative safety. But when this same process is applied to a potent agent like chloral, the chances are always greatly in favour of the substance doing more harm than good, until a panic and a prejudice are produced against it, when it may be unjustly condemned and lost.

The definite results from the careful and proper use of chloral, and its great importance in filling a place in therapeutics hitherto vacant, fortunately secure it against being lost by this reaction; and it is perhaps well, therefore, that by the sacrifice of a few lives at the outset of its career, many lives may be saved, and its use be

restricted to the hands of physicians. Pharmacists cannot be too careful how they advise or dispense such agents for popular use, and they will undoubtedly be, sooner or later, held responsible for all the misuse to which their commodities may be applied.

The experience and education obtained in the making of some 1500 lbs. of chloral within the past year have served to improve the writer's knowledge of this important substance, and may justify him in offering some remarks upon its characteristics and tests.

Since it has become easier to make the hydrate than the alcoholate of chloral, the latter, and all mixtures of it, have practically disappeared from the market without any probability of their ever re-appearing. This renders the tests for alcohol and alcoholates unnecessary.

When the water of hydration is in excess, or when solid compounds of hydrate of chloral and water are put up, the substance is deliquescent, or even melts in warm weather, and a very slight excess of water manifests itself very soon by some degree of deliquescence. Whether in cake or crystal, it is now very generally put up slightly deficient in water of hydration; that is, the chloral is not fully saturated to the condition of a full hydrate, and under proper control this is the best practice yet arrived at by the writer. If it could be exactly saturated, that of course would be best; but, as this seems not easily practicable it is best to have the water a little short of full hydration. If more than a shade short, however, the hydrate is proportionally pungent, because anhydrous chloral is much more pungent than the hydrate. Another disadvantage of the presence of free or anhydrous chloral is, that it renders the hydrate which contains it more liable to become slightly acid. These circumstances, and the fact that under varying conditions chloroform dissolves more or less water, and watery solutions dissolve more or less chloroform, together render the chloroform test fallacious and comparatively useless as ordinarily applied. That is, the yield of chloroform may be always the same if the decomposition be complete, but it cannot be weighed or measured with sufficient accuracy.

Chloral has now been made in such quantities, and with so much competition, and it is so comparatively easy to make it of fair quality, that the mistakes and imperfections arising from ignorance are now no longer made, and the general quality has got far beyond the reach of the earlier tests. More sensitive and more delicate tests are now needed—not to decide whether a given substance is hydrate of chloral, but to decide between different specimens of hydrate of chloral which come into the markets, even from the same manufacturer—as to which contains the least or the most of other and mere accidental products of the action of chlorine on alcohol. In all the better brands these accidental products are in very small proportion, and not easy of detection. Just as in the instance of chloroform, they are neither made nor left in it purposely or carelessly, and the defect lies simply in the insufficiency of the means and the labour necessary to take the last portions out. Within practical limits they may all he taken out by any of the processes in use for the purpose, provided these be used with sufficient skill, pains, and labour; and the want of uniformity of the best brands now in the market is chiefly due to want of care and labour. That is, profit being the chief object, this is increased by dodging its greatest enemy, namely, skilful labour.

After a large number of examinations, the writer comes to the conclusion that at present there is no single test which will indicate the quality of chloral, and that the value of any group of tests depends almost entirely upon the skill and care with which they are applied. The sensible properties are very characteristic to those who are expert and familiar with the substance, and by a little education and practice any one may soon attain a pretty critical judgment.

The writer still greatly prefers the granular crystalline form to any other, as conducive to greater purity, and the most simple and critical mode of examination known to the writer, and which has not been hitherto published, is by means of chloroform. Chloral and its hydrate are both freely soluble in chloroform, and from this solution, when dropped on bibulous paper or evaporated from a watch-glass, the chloroform flies off first, the anhydrous chloral next, and the hydrate last and more slowly. The impurities are still less volatile, and may be detected in the later stages of the evaporation by their different odour. The hydrate of chloral, after the last traces of anhydrous chloral have passed off, is comparatively inodorous, and what odour it has is very mild, sweet, and clean, so that any contamination of this mildness and sweetness is the more easily recognised. The chloroform used must of course be itself free from much impurity, and should not colour sulphuric acid. The solution of chloral in chloroform, when tested with sulphuric acid, just as chloroform is tested, should give no colour to the acid. The acid should be poured slowly into the chloroform solution, when the slightest change of colour can be seen at the line of separation between the two liquids before they are shaken together. Indeed, after shaking, the coloured stratum becomes so diluted by the excess of acid, that the tint may be hardly recognisable. So delicate is this test that, when carefully and properly managed, no specimen of chloral has ever been seen, except when taken directly from the purifying flasks, that would not give *some* colour at the line of separation between the liquids. That is, the atmospheric dust, which is unavoidable in the handling and putting up of the chloral, is sufficient to give a tinge at the line of separation. As in the case of chloroform alone, the colour, however much or little, increases by standing, and is only fully developed after twenty-four hours. In this testing the chloroform alone should be tested, side by side with the chloroformic solution of chloral, and only the difference be taken into account. Of course colourless concentrated sulphuric acid should be used, and a chemically clean glass-stoppered bottle, as in the testing of chloroform.

The next important step in the examination, not hitherto published, is the freezing-point, or the temperature at which the chloral begins to crystallise when melted. This point appears to be very definite, and is very easily ascertained. An ounce bottle of chloral, as purchased, should have the glass stopper loosened, but not removed (it should never be sold in any other than glass-stoppered bottles), and the bottle should be then immersed to the shoulder in warm, not hot, water, and occasionally shaken until the chloral is melted. The liquid chloral should, of course, be colourless, transparent, and free from specks of foreign matter to a practical degree. The bottle should then be taken from the warm bath, the stopper removed, and, while held by the neck, the bulb of a small chemical thermometer should be placed in the liquid and used continuously as a stirrer until the liquid becomes opalescent or loses its bright transparency. At this moment the temperature should be taken and noted. The bottle is then again placed in the warm water, and the contents stirred until again transparent; then again removed from the bath and again stirred to the crystallising point, and the temperature again noted for verification of the first trial. This does not waste nor injure the chloral at all, and the thermometer, when removed, should be immersed in distilled water in a small test-tube, to dissolve off the adherent chloral. The solution thus obtained, if tested with pale blue litmus-paper, will commonly indicate slight acidity, and with solution of nitrate of silver will give slightly more cloudiness than the water alone will give. The writer has never tested a specimen of chloral which had been six months made, which did not give evidence of slight hydrochloric acid acidity, if the testing was delicate. Hence it is not amiss, though perhaps not important, to add a drop or two of ammonia to all solutions of chloral when dispensed for use, as originally advised by Liebreich, since it may serve to arrest a commencing decomposition which might soon become rapid in the

solution, particularly when the solution is to be kept many days, or when it has organic matter of any kind in it.

To return to the freezing-point. Specimens of chloral from the best makers may be found in the market, which begin to crystallise at from 45° C. = 113° F., up to 52° C. = 125·6° F. The best specimens, however, crystallise between 48° C. = 118·4° F., and 51° C. = 123·8° F. Those which crystallise at the higher temperatures contain the most anhydrous chloral, and those which crystallise at the lower temperatures contain an excess of water. Accurately hydrated chloral crystallises at about 48° to 49° C. = 118·4° to 120·2° F., and the best practically adjusted specimens crystallise within one-half a degree of 50° C. = 122° F. Specimens which crystallise below 48° C. = 118·4° F. do not stand summer temperatures without becoming moist, whilst those which crystallise below 47° C. = 116·6° F., are proportionately deliquescent. This tendency to deliquesce is, however, mainly due to the interstitial mother-liquid, and this liquid it is which absorbs the moisture of the atmosphere, and thus finally dissolves the crystals in warm weather. Hence, as large crystals can only be obtained by comparative slow crystallisation from more dilute solutions, they contain the most watery liquid in the interstices, and therefore soonest deliquesce. A basin of large crystals, looking somewhat like bromide of potassium, in regard to the size of crystal, stood upon the writer's table covered loosely with paper, from March until September. Up to the 1st of June they remained quite dry, and could be powdered as easily as bromide of potassium. They then began to grow moist, slowly at first, but very rapidly during the latter part of July, and now in September there is a confused mass of crystals at the bottom of the capsule, covered by an inch or more of transparent syrupy liquid.

A few pounds of these same crystals standing in the same place, in an imperfectly stoppered, wide-mouthed bottle, and this frequently opened, have kept much better, and are in fair condition, though moist. Small granular crystals, which form from the melted chloral when carefully underhydrated, seem to be by far the best form for convenient practical use.

All the writer's experiments, and they have been numerous, of crystallising from bisulphide of carbon, from ether, from chloroform, and from oil of turpentine, have failed in practicability.

Another important test of quality for commercial chloral is its boiling-point. This was early recognised as a test, because no two liquids are known which boil at precisely the same temperature, while all mixtures are known to have a moving boiling-point, that is, do not boil continuously at any fixed temperature. Writers, however, have given a very different value and significance to this test, some regarding it as no test at all, while others have considered it infallible. This discrepancy appears to depend upon the skill or want of skill and knowledge with which the test was applied. Most liquids can be heated far above their boiling-point without boiling, but all can be made to boil at the normal boiling-point by proper management. Chloral simply heated in a clean test-tube may, or may not, boil at its boiling-point. But if the test-tube be one-sixteenth filled with broken glass, and be heated in a glycerine bath, the chloral will boil at its normal boiling-point, and will continue to do so, and a chemical thermometer immersed in it will indicate the boiling-point with accuracy.

Accurately hydrated chloral begins to give off bubbles of vapour from the hottest surfaces of the tube when the thermometer indicates about 90° C. = 194° F., but it does not properly boil throughout the liquid below 97° C. = 206·6° F., and one-half of it at least will boil off before the temperature varies much from this point. It however appears to gradually decompose from air contact, or some other cause, underhydrated chloral boiling off, and overhydrated chloral remaining, so that the boiling-point gradually rises after boiling for some time. The best commercial specimens of chloral—that is, a little underhydrated—begin to boil throughout the liquid at about 96·5° C. = 205·7° F. The underhydrated portion, however, boils off in a few seconds, and the thermometer rises to 97° C. = 206·6° F., and finally to 97·5 or 98° C. = 207·5° or 208·4° F., by the time that half the liquid has boiled off.

Chloral should not begin to boil fairly below 95° C. = 203° F., because if it does it is too much underhydrated, and therefore too liable to decomposition ; and it should boil down to one-half steadily at 97° to 98° C. = 206·6° to 208·4° F. If it boils off above 98° C. = 208·4° F., the indication is that it is overhydrated and deliquescent.

The natural accidental impurities which are left in the chloral are, in all the better grades, in so small a proportion as to escape detection by any ordinary application of the boiling-point test.

In conclusion, it may be remarked that, while several of the grades of chloral now to be found in the market are worthy of confidence, they are by no means uniform, but are improving in this respect ; and there is no reason to fear that good chloral will ever again be accessible at a moderate price. The enormous scale upon which it has been made in Germany, and the difficulty of reducing this scale to meet the reaction which fatal cases of poisoning in popular use has caused, have overstocked and very much depressed the market ; and it is to be feared that some of this overstock may become decomposed before it can be consumed. The quality should therefore be closely watched, and as soon as a parcel is found to be strongly acid it should be rejected. The test of acidity by means of a glass rod wet with solution of ammonia held near the mouth of the bottle, though useful, is not entirely trustworthy, and is hypercritical, since the vapour of anhydrous chloral, whether of itself or by slight decomposition from air contact, produces a cloud with ammonia.

ON THE

STYLE OF GAS-BURNER FOR BENDING GLASS TUBES.

By H. CARRINGTON BOLTON.

Professor J. Lawrence Smith, in a note "On Bending Glass Tubes for Fitting Apparatus" (Chemical News, vol. xxv., p. 175), recommends a Bunsen burner flattened at its extremity so as to give a thin broad flame. This is certainly a great improvement on the commonly employed burner, but an ordinary fish-tail or bat-wing gas-burner will be found to give, if possible, still better results. The writer has employed for some years an ordinary bat-wing burner attached to a small, short stand (3 inches high, burner included), so as to rest low upon the table, in order that raising the arms inconveniently high may be avoided. Such a burner insures a broad flame, by which the tube is heated for two or more inches in length ; the tube is turned while in the flame, and removed for bending as usual.

The deposit of carbon, which, at first sight, might seem an objection, is really one of the chief advantages of using this burner. On placing the glass in the flame, the deposit begins immediately and prevents too rapid a rise of temperature and consequent cracking of the glass ; during the heating the carbon tends to distribute the heat equally over the surface of the tube ; and, finally, on withdrawing the glass from the flame too sudden cooling is prevented, and the glass is, as it were, annealed.

The black deposit is readily removed by a dry cloth. This plan was commonly employed in Hofmann's laboratory, Berlin. In bending tubes of more than three-eighths of an inch in diameter, one end should be closed tightly with a cork (or wax) and air blown into the other end at

the moment of bending the tube; by regulating judiciously the pressure of the air upon the sides of the somewhat softened tube, the latter will neither bulge out nor collapse, but will retain its proper calibre. This cannot be effected, however, with very large tubes, or with very thin ones, which require the nice manipulation of the professional glass-blower.—*American Chemist.*

ON THE ECLIPSE EXPEDITION, 1871.*

By J. NORMAN LOCKYER, F.R.S., M.R.I.

I UNDERSTAND my duty to-night to be to give an account of the observations made, not by all who observed the eclipse of last December, but by the members of the party which went out under the auspices of the British Association, and it is extremely fortunate that nothing more is required of me—first, because most valuable work was done by the other parties, which of itself would require more time to state than I have at my disposal; and secondly, because the amount of material obtained by the members who were sent out from England, and by the friends who met them at every point, is so great, that it would be impossible in one discourse to give anything like an exhaustive account of it. Here are some of the records in this portfolio. You will see at once that even for one party I can only make a selection, and I am perfectly aware of the extreme responsibility which attaches to anyone who may venture to make a selection out of such an enormous mass of material as we have collected.

Before I proceed to discuss the work done by the different parties, it will be desirable to give an idea of the arrangements, and for this purpose I have prepared several maps, which will enable you to see what the British Association parties did.

In the first instance, I may remark that the weather conditions were somewhat problematical. Another point of great importance was that much of the ground was fortunately occupied, and it was essential, when placing the parties, to bear these two considerations in mind—the possibility of bad weather; and then the importance of so arranging matters that, if some of the observers were clouded out belonging to our parties, then the story might be continued by other observers.

Here we have a map of India, which gives you a general idea of the path of the shadow during the eclipse. The shadow, you see, strikes India on the western coast, and it runs down in a south-westerly direction and cuts the northern portion of Ceylon.

When we arrived in India we found that the Indian observers, consisting of those well-known men, Tennant, Herschel, Hennessy, Pogson, and others, had determined, from their knowledge of the climatic conditions of India at that time of the year, to occupy the central part of the line, and also a station at a low level; the eminent French physicist, M. Janssen, taking up his position at the top of the Nielgherries. We were to station ourselves either east or west, or both, of these parties. Whether east or west would depend upon the monsoon, and the great question that was being discussed on our arrival was, Was the monsoon favourable?

I have not time to go into the many interesting points touching the answer to this question; but I may say shortly that what we heard was, that if the weather was likely to be bad on the east side of the hill range, generally called the Ghauts, there was a good chance for anyone occupying a position west of those hills. What happened was that we did occupy the positions marked by blue wafers on the map, viz., Bekul on the west coast, Manantoddy on the western slope of the Ghauts, Poodocottah in the eastern plain, and in the Island of Ceylon—first, Jaffna, and secondly, Trincomalee.

Such were our arrangements. The parties were stationed along the line of totality. Very different were the arrangements of the Sicilian party of the former year. In Sicily we were compelled to throw ourselves *across* the line of totality in the direction which I have indicated on this map of Sicily.

Now what was the work we had to do? If you will allow me to refer to two or three results of the former eclipse Expedition, I will endeavour to put them before you without taking up too much of your time.

One of the most important among the results obtained in the eclipse of 1870 was this:—Far above the hydrogen which we can see every day without an eclipse—far above the prominences, the spectrum of hydrogen had without doubt been observed by two or three of the American observers, who were more fortunate than we were. Among them, Professor Young stated that the spectrum of hydrogen was observed to a distance of 8 minutes from the sun; he then adds, "far above any possible hydrogen atmosphere." This is point number one.

Another of the points was this: the unknown substance which gives us a line coincident, according to Young, with a line numbered 1474 by Kirchhoff, has been observed by the American observers to a height of 20 minutes above the limb of the dark moon.

Now, it was a very obvious consideration that, if we got a spectrum of hydrogen 8 minutes from the dark moon, when we thought we knew that the hydrogen at the sun did not really extend more than 10 seconds beyond the dark moon, there was something at work which had the effect of making it appear very much more extensive than it really was; and it was fair to assume that, if this happened in the case of the hydrogen, it might also happen in the case of the unknown stuff which gives us the line 1474.

In support of this view we had one of the few observations which were made in Sicily, in the shape of a drawing of the corona, as seen by Professor Watson, who observed at Carlentini. He saw the corona magnificently; and being furnished with a powerful telescope, he made a most elaborate drawing of it, a rough copy of which I will throw on the screen. You will see at once that we had in this drawing something which seemed to militate against the idea that the 1474 stuff at the sun did exist to a height of 20 minutes. According to Professor Watson, the boundary of the real corona was clearly defined, its height being far under that stated.

Next, we had another observation of most important bearing on our knowledge of the base of the corona. I refer to the announcement of the observation by Professor Young of a stratum in which all the Fraünhofer lines were reversed. It was asserted that there was undoubtedly a region some 2 seconds high all round the sun, which reversed for us all the lines which are visible in the solar spectrum. We had, in fact, in a region close to the photosphere, the atmosphere of the sun demanded by Kirchhoff at some distance above the photosphere.

Last, not least, we had the photographic evidence. There was in Sicily a photographic station at Syracuse, and the Americans had another in Spain. I now show on the screen a drawing—it is not the photograph itself, but a drawing of a photograph made by the party in Sicily; what we have on this photograph is a bright region round the dark moon, which is undoubtedly solar, but stretching out right away from this, here and there, are large masses of faint light with dark spaces between them, which have been called rifts. Now the question is, Is this outer portion solar?

Having thus brought rapidly before you some of the questions which we had principally to bear in mind, and, if possible, settle (though that is too much to hope for in any one Eclipse Expedition) in the work we had to do in India, I will next bring to your notice some new methods

* A Lecture delivered before the Royal Institution of Great Britain. The chief results obtained by the expedition have been taken from the *ad interim* Report presented to the British Association Meeting at Brighton. The lecture itself dealt mainly with the methods and instruments employed.—J. N. L.

of inquiry which had been proposed with the object of extending former observations.

I may here remark that the Royal Astronomical Society, in the first instance, invited me to take charge of an expedition to India merely to conduct spectroscopic observations; but, although this request did me infinite honour, I declined it, because the spectroscope alone, as it had been used before, was, in my opinion, not competent to deal with all the questions then under discussion. I have told you that some of the most eminent American observers had come to the conclusion that the spectrum of hydrogen observed in the last eclipse round the sun, to a height of 8 minutes, was a spectrum of hydrogen "far above any possible hydrogen" at the sun. Hence it was in some way reflected. Now, with our ordinary spectroscopic methods, it was extremely difficult, and one might say impossible, to determine whether the light which the spectroscope analysed was really reflected or not; and that was the whole question.

It became necessary, therefore, in order to give any approach to hopefulness, to proceed in a somewhat different way in the 1871 expedition, and, in order to guard against failure, to supplement such new observations by photographs; and fortunately we were not long in coming to a conclusion that this might be done with some considerable chance of success.

I have here a train of prisms. I will for one moment take one prism out of the train, and we will consider what will happen if we illuminate the slit of the lantern with a monochromatic light, and observe it through the prism. If we render sodium vapour incandescent, we know we get a bright yellow image of the slit, due to the vapour of the metallic sodium only giving us yellow light. But why is it that we get a line? Because we always employ a line for the slit. But suppose we vary the enquiry. If, instead of a straight line, we have a crooked line for the slit, then we ought to see a crooked line through the prism. Now allow me to go one step further. Suppose that, instead of a line, whether straight or crooked, we have a slit in the shape of a ring, shall we see a ring through the prism? You will see that we shall. And then comes this question: If, when we work in the laboratory, we examine these various slits, illuminated by these various vapours, why should it not happen that, if we observe the corona in the same way, we shall also get a ring built up by each ray of light which the corona gives to us; since we know, from the American observations, that there were bright lines in the spectrum of the corona, as observed by a line slit? In other words, the corona examined by means of a long train of prisms should give us an image of itself painted by each ray which the corona is competent to radiate towards us.

Now let us pass to the screen, the screen merely replacing the retina. We will first begin with the straight slit, with which you are familiar—we now have our slit fairly focussed on the screen—we then in the path of the beam interpose one of these prisms, and there we get on the screen a bright line.

Now, to continue the argument, we replace the straight slit by a crooked one, and you see we get a crooked image on the screen. We now replace this crooked slit by a ring. We have now a ring-formed image on the screen. So that you see we can use any kind of narrow aperture we choose, and as long as we are dealing with light which is monochromatic, or nearly so, we get an image of the aperture on the screen.

If we consider the matter further, it will be evident that we may employ a mixture of vapours, and extend this result.

We will now, for instance, instead of employing sodium vapour, employ a mixture of various vapours. You see now that each ray given by these substances, instead of building up a line image, is building up for us a ring image—that we have now red, green, yellow, blue, and violet rings.

Now that was the consideration which led to the adoption of one of the new attempts to investigate the nature of the corona used this time. It was, to use a train of prisms, pure and simple, using the corona as the slit, a large number of prisms being necessary to separate the various rings we hoped to see, by reason of their strong dispersion. On the screen the rings to a certain extent intersect each other; and it would have been easier to show you the ring-form of the images if we could have used more prisms than one.

If this is good for a train of prisms such as I have referred to, it is good for a single prism in front of the object-glass of a telescope. Such was the method adopted by Prof. Respighi, the distinguished Director of the Observatory of the Capitol of Rome, who accompanied the expedition.

Now you may ask, How would this method, if it succeeded, be superior to the ordinary one. In this way. If we were dealing merely with reflexion, then all the rings formed by vapours of equal brilliancy at the base of the chromosphere would be of the same height, while if reflexion were not at work the rings would vary according to the actual height of the vapours in the sun's atmosphere, and the question would be still further advanced if the spectrum did not contain a ring representing the substance which underlies the hydrogen.

Our *new* spectroscopic equipment, then, was as follows:—

1. A train of five prisms.
2. A large prism of small angle placed before the object-glass of a telescope.
3. Integrating spectroscopes *driven by clockwork.*
4. A self-registering integrating spectroscope, furnished with telescopes and collimators of large aperture, and large prisms. (This instrument was lent by Lord Lindsay.)

Now a word about the polariscopic instruments, referring you to my lecture given last year for a general notion of the basis of this class of observation.

A new idea was, that observations to determine the polarisation of the corona might be made with the same telescope and eye, both with the Biquartz and the Savart.

By the kindness of Mr. Spottiswoode, who has placed his magnificent polarising apparatus at our service, I hope to be able to show you on the screen the mode of examining the corona by means of those two instruments, so as to enable you pretty well to follow what was actually done.

Let me begin with the Biquartz polariscope. In the first instance I will throw on the screen a representation of the corona itself, and we will then insert a Biquartz, and see its effect when I flood the screen with polarised light. You now see an indication of what would be observed supposing the polarisation was due to polarised light diffused in the region between us and the dark moon and eclipsed sun, in which case the polariscopic effect would be observed generally over the dark moon, the corona, and the region of the sky outside the corona. But this is not all; not only does this arrangement enable us to determine the existence of such a general polarisation, but the vertical line in the Biquartz called the line of junction indicates the plane of polarisation, when the colours on both sides of it are the same; so that we have two colours strongly contrasted in either half of the field when we are away from the plane of polarisation, and a uniform colouring of the whole field when in or at right angles to that plane. By turning this prism through 90 degrees, you see I entirely change the colours.

But we are not limited to the Biquartz in this inquiry. We can apply the Savart polariscope. Having still our image of the corona on the screen, I now replace the Biquartz by a Savart.

We now no longer see a line of junction with the similar or different colours on either side of it, but lines of colour running across the image. I turn the prism. We first see the lines with a white centre, then with a dark one, while at times they are altogether absent. And as a departure from the plane, when we use the Biquartz, gives us the strongest contrasts of colour, so you observe that

with the Savart under these circumstances all indications of polarisation vanish.

Now, if we assume polarisation to be general, and the plane of polarisation vertical, we should get those coloured bands, as you see them there, crossing the corona and dark moon, the lines being vertical and dark-centred. If the plane of polarisation were horizontal, we should find the lines horizontal and the central one white.

But so far as we have gone we have been dealing with polarisation which is general, and we have not attempted to localise polarisation at the corona itself. But I have here an apparatus, by means of which, quietly, in this theatre, one can see as admirable an example as we should desire of polarisation, assumed to be particular to the sun and not general—I mean radial polarisation. We have simply a circular piece of mahogany, or something else which polarises light equally well, with a hole in the middle with sloping sides, cut as you see this cut, and then we place behind it a candle, so that the light of this candle, after falling on oiled tissue paper stretched across the aperture, can be reflected to the eye by the sides, the direct light of the candle being stopped by a central metallic diaphragm. We have now a source of polarised light of a different kind from the last. The next thing we have to do is to introduce into a small telescope exactly the same kind of apparatus we have there, though of course on a much smaller scale, and examine the ring of light seen when we put the candle behind the aperture. On examining the ring of light which is now visible by means of this telescope, which contains a Biquartz and analyser, I see the most exquisite gradations of colour on either side the line of junction which cuts the field of view and the bright ring in the centre into two.

Now, instead of the candle, we will employ the electric lamp; and instead of the eye, the screen; but I must inform you that the great heat of the electric lamp prevents the appearance being perfectly successful on the screen, as the reflecting varnish is melted.

In this experiment we cannot work with an image of the corona. We must make our corona out of the image of the ring we hope to get on the screen, and then, by employing the Biquartz in the same way as before, instead of getting similar colours on either side of the line of junction, as we did when we were working in the plane of polarisation, and getting the greatest contrasts, as we did when we worked 45 degrees away, you observe we get different colours in each part of the ring.

On the screen we now have a highly-magnified image of the hollow cone of iron which I am compelling to reflect the light from the lamp; and by inserting this Biquartz I throw various colours over different portions of that ring, which I beg you to consider for one moment as the solar corona, and the colours change as I rotate this prism. You will at once be able to explain the different actions of this Biquartz in this instance. The reflexion, and therefore the plane of polarisation, is no longer general, but varies from point to point of the reflecting surface. It is in fact radial, and hence the delicate radiate arrangement of colour.

Such, then, were some of the new methods and new instruments we used, for the first time, in our researches.

(To be continued.)

NOTICES OF BOOKS.

Investigation of some of the Ammoniacal Waters of Gas-Works, and on the Presence of Chlorine Compounds in Coals. By Dr. G. Th. Gerlach.

This essay contains in detail the method of analysis and the results of the author's researches on several kinds of ammoniacal liquor, as obtained from various kinds of coal at some of the German gas-works. As instances, we quote the following:—100 c.c. of the ammoniacal liquor of the Chemnitz (Saxony) gas-works, where Zwickau coal is used, contain, in grms.—Hyposulphite of ammonia, 0·1036; sulphuret of ammonium, 0·0340; bicarbonate of ammonia, 0·1050; carbonate of ammonia, 0·4560; sulphate of ammonia, 0·0462; sal-ammoniac, 3·0495. Gas-water from the Bonn gas-works, where Ruhr coals are used, contains, in 100 c.c., in grms.—Hyposulphite of ammonia, 0·5032; sulphuret of ammonium, 0·6222; bicarbonate of ammonia, 0·245; carbonate of ammonia, 3·3120; sulphate of ammonia, 0·1320; chloride of ammonium, 0·3745. The author calls special attention to the fact that the presence of chlorine compounds in coals has been hitherto overlooked, because these compounds are volatilised in the shape of chloride of ammonium when the coal is incinerated. The quantity of chloride of sodium in the Zwickau coal amounts to about 3 per mille, and, since it contains about 2 per cent of ash, that ash should contain about 15 per cent of chloride of sodium.

Das Anthracen und Seine Derivate. Für Tecknik und Wissenschaft nach der bis jetz bekannten Quellen Zusammengestellt. Von G. Auerbach, Assistent am Eidgenossischen Polytechnicum zu Zürich. Berlin: O. Seehagen. 1873.

This work is scientifically and industrially of great value. We quote the headings of the leading chapters:—Introduction, containing historico-scientific review of the discovery of anthracen in 1832 by Dumas and Laurent, who called it paranaphthalin, and a *resumé* of the researches of a large number of *savants* up to the present day; constitution of anthracen and its derivatives; preparation and properties of anthracen; hydrides of anthracen; bromine derivatives of anthracen; chlorine and anthracen; nitro- and sulpho-compounds of anthracen; azo combinations of anthrachinon; other combinations of anthrachinon; alizarine (this chapter contains valuable information on the researches on madder, its preparations, its colouring principles, and its chemical combinations); chrysophanic acid; chrysamminic acid; franguline; frangulinic acid; an appendix, containing practical receipts for dyeing with native and artificially-prepared alizarine, The author is to be congratulated for the clear and excellent manner in which he has treated his subject. In addition to a general index, we notice a plan which might be more generally adopted, under the title of "Autoren register," an alphabetically-arranged index; for instance, under Alizarine we find a complete list of, not only the names of authors, but the periodicals in which their essays are published. The numerous and complex formulæ are prominently set forth.

CORRESPONDENCE.

SANITARY ARRANGEMENTS OF THE METROPOLIS.

To the Editor of the Chemical News.

Sir,—I beg most respectfully to submit the following for the favour of your consideration; my apology for doing so being that it is a sanitary question of considerable importance, not merely to the inhabitants here in particular, but to the public generally. Our Medical Officer of Health states that there are 100 fish-smoking houses in this parish. One of these is in the heart of a densely populated neighbourhood. In it are cured—according to the report of our own Medical Officer of Health—every night, including Sundays, between 40,000 and 50,000 herrings. Fourteen fires, made from the roots of oak and hornbeam, are burning therein at one time, the fumes of which roll out in volumes filling our houses with noxious

gases, even when our doors and windows are shut. The louvre boards from which the effluvium escapes are at the same elevation as our bedroom windows, and there is no chimney-shaft to carry the effluvium away from our abodes.

Four physicians. viz.—Dr. Godfrey, 33, Finsbury Square; Dr. Bate, 412, Bethnal Green Road; Dr. Tripe, 172, Richmond Road, Hackney; and Dr. Simpson, 233, Hackney Road—have certified the smoke-house a public nuisance, and greatly injurious to health. Numbers of chemists in this neighbourhood have affirmed the same thing. The Vestry—men who know no more of chemistry than a codfish—having been applied to repeatedly by the inhabitants, have not only persistently refused to abate or remove the pest, but have always avowed themselves the defenders and patrons of it. We have also petitioned the Local Government Board, but they declare themselves powerless to do anything except to endorse the decision of the Vestry. Therefore our health is being wantonly destroyed without remedy, because this is too poor a neighbourhood for us to be able to bear the legal expenses necessary to suppress the nuisance which was brought to us, for we did not come to it, and our removing from it would in many cases involve the breaking up of our homes, and the ruin of our business, with the chance of some other nuisance equally pernicious being brought to us in whatever other place we might remove to. If this is Vestry and Local Government Board management, of what use is either of them? So far as our health is concerned we could not be worse off under Turkish despotism. —I am, &c.,

R. M. Gurnell.

17, Peel Grove, Old Ford Road, Bethnal Green,
October 29, 1872.

A MODIFICATION OF MOHR'S BURETTE.

To the Editor of the Chemical News.

Sir,—In reference to the letter of Mr. Edward Collens in your Paper of the 24th inst., in which he claims to have adopted the modification of Mohr's burette which was published in your previous number, we beg to say that having referred to his paper we at once admit the justice of his claim, and regret that we were not aware of it when we sent our description of what we believed to be quite new.

We are still of opinion that our plan in its details will be found the more convenient of the two, as it neither involves the long glass tube (with its great liability to fracture), nor any material alteration of the burette; but, nevertheless, the utmost we can claim is to have *improved* the arrangement.

Having said this, we feel the more at liberty to express our surprise at the objections urged against this plan, as in practice we find it nearly perfect. The leakage is absolutely *nil* in moderate sized burettes. The air bubble is less than in the ordinary arrangement, and the difficulty in regulating the flow from a large orifice can be effectually overcome by applying a screw pinch-cock in addition to the ordinary one.—We are, &c.,

M. Heriot,
R. Biggs.

A MODIFICATION OF MOHR'S BURETTE.

To the Editor of the Chemical News.

Sir,—Permit me to reply to your correspondent, who recites his experience on the above subject as gained in Messrs. Vernon Harcourt and Esson's investigations.

His first charge, which relates to the changes of temperature influencing the readings, is perfectly correct, but the error from this source is not such as to condemn the burette. The temperature of a laboratory is not, as a rule, subject to violent fluctuation; nor, at least in the majority of cases, is it necessary, when using a burette, to preserve the same reading hour after hour.

His second objection, viz., the difficulty experienced in delivering single drops by this arrangement, can be completely overcome by substituting a screw-clamp for the ordinary pinch-cock—such things are to be obtained of the apparatus dealers; and by its use a whole buretteful of fluid may, with the greatest ease, be delivered drop by drop, either fast or slow, without the clumsy suggestion of your correspondent's, which would defeat its own end by causing the instrument to drop after the supply of air had been cut off.

It is hardly necessary to reply to his third objection. A chemist who cannot fit a cork into a half-inch tube, and pass another and much smaller tube through it sufficiently tight to sustain a pressure of, say, 1 lb. on the square inch, is scarcely an authority on manipulation.

I quite agree with his remarks upon the superiority of the glass stop-cock modification, but every laboratory is not fitted with these. The real use of the modification in question is the ready means it affords chemists of converting their Mohr's burettes in a few minutes into instruments capable of being used with any test-liquors, an advantage which might have been disregarded had your correspondent's remarks not been replied to.—I am, &c.,

Edward Collens.

Birmingham Vinegar Brewery,
October 28, 1872.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, October 28, 1872.

This number contains the following original papers and memoirs more particularly relating to chemistry:—

Researches on Fermentation.—E. Fremy.—A reply to a question by Pasteur. An animated debate followed the reading of the paper at the meeting.

Researches on Crystalline Dissociation; Alums.—P. A. Favre and C. A. Valson.—The continuation of an exhaustive essay on this subject, elucidated by a series of tables.

New Studies on Valerianic Acid and its Preparation on the Large Scale.—I. Pierre and E. Puchot.—Valerianic acid, obtained by the oxidation of amylic alcohol, and concentrated as much as possible, boils at 178°, and has at 0° a sp. gr. = 0·947, and at 147·5° = 0·8095; the acid contains 1 equivalent of water, which cannot be eliminated by distillation. When in the presence of an excess of water, it boils at between 99·8° and 100°, forming vapours, which, by their condensation, yield two distinct layers of liquid; the lower layer is an aqueous solution of the acid, and the upper one is a hydrate of the acid; the proportion of these layers to each other is as 23 to 77. Valerianic acid causes the plane of polarisation to deviate in the same direction as crystallised sugar, while amylic alcohol does the reverse.

New Studies on Butyric Acid.—I. Pierre and E. Puchot.—Butyric acid, obtained by the oxidation of butyric alcohol, boils at 155·5° when quite concentrated, and has at 0° a sp. gr. = 0·9697, and at 139 = 0·822; this acid does not act upon polarised light. The formula of dry butyrate of baryta is $C_8H_7O_3,BaO$. Ethylic butyrate boils at 113°, and has at 0° a sp. gr. = 0·89, and at 100° = 0·779. Methylic butyrate boils at 93°, and has at 0° a sp. gr. = 0·9055.

Note on the Purple of Cassius.—H. Debray.—Reserved for full translation.

Smelting of Platinum.—H. Violette.—The author describes a small blast-furnace constructed by him at a chemical work at Lille, and communicating with the factory chimney; by the aid of this furnace the author states that he has been able to smelt 50 grms. of platinum placed in a crucible made of graphite placed in a fire-clay crucible. The heat generated is, according to the author, exceedingly great, although the cubical capacity of the furnace is only 45 litres. Coke was first used as fuel, but the author has found it better to use the graphite, as it does not contain ash. There is added to this paper a footnote by the Perpetual Secretary of the Academy, who asks

whether it is not possible that the platinum may have taken up a trace of carbon, silicium, or sulphur, whereby its fusion-point is lowered.

Chemical Researches on the Leaves of the Eucalyptus Globulus.—Dr. Rabuteau.—The author states that these leaves contain no alkaloid.

Researches on the Physiological Theory of the Alcoholic Fermentation set up by Beer Yeast.—A. Béchamp.—The contents of this monograph are not suited for abstraction.

Annales de Chimie et de Physique, November, 1872.

This number contains the following original papers and memoirs:—

Simple Reactions Limited by Inverse Action; Application to the Conversion of the Phosphorus.—G. Lemoine.—The first portion of an exhaustive monograph, elucidated by algebraical and chemical formulæ and tabulated forms, and divided into the following sections:—Non-limited simple reactions; dissociation, homogeneous system; dissociation, non-homogeneous system; allotropic conversion of phosphorus.

Researches on Aromatic Combinations.—Dr. A. Wurtz.—The second instalment of this memoir contains the following chapters:—Synthesis of aromatic acids; synthesis of benzoic and toluic acids; dibenzyl-carboxylic acid; salts of this acid.

New Locality for Amblygonite; and on Montebrasite, a New Phosphate of Alumina and Hydrate of Lithia.—M. Des Cloizeaux.—This essay, illustrated by woodcuts, is in substance the same as that already quoted from the *Comptes Rendus* (see CHEMICAL NEWS, vol. xxiv., p. 97).

Silicic Mercaptan and a Chlorobromide of Silicium.—C. Friedel and A. Ladenburg.—After referring to the researches of I. Pierre on chlorosulphuret of silicium, the authors state that they prepared a larger quantity of that substance, care being taken to render it pure; on continuing their researches they found that the compound discovered by M. Pierre is a chlorosulphydrate of silicium which may be viewed as a terchloride of hydrosulphuric acid; this body is a limpid colourless liquid, which boils at 96°, exhibits the odour of sulphuretted hydrogen and hydrochloric acid, and is decomposed by exposure to air, the two volatile acids escaping, and silica being deposited. Absolute alcohol decomposes this compound at the ordinary temperature, hydrochloric acid being set free; the formula of this compound is $SiCl_3SH$. The chlorobromide of silicium, $SiCl_3Br$, is a colourless liquid, decomposed by the addition of water into silica and chlorhydric and bromhydric acids; boiling-point, 80°; vapour density, 7·25 (theoretically 7·42). The chlorosulphydrate of silicium may be considered as analogous to the methylic mercaptan, CH_3SH.

Mixed Silico-Acetic Anhydride.—C. Friedel and A. Ladenburg.—After first referring to the labours of Gerhardt, Kaemmerer, Carius, Menschutkine, and others, on mixed mono- and poly-basic anhydrides, the authors describe the preparation of this compound by the reaction of chloride of silicium upon acetic or anhydrous acids; this reaction is elucidated by the following formulæ:—

$$SiCl_4+4(C_2H_4O_2) = SiO_4(C_2H_3O)_4+4HCl, \text{ or—}$$
$$SiCl_4+4(C_2H_3O)_2O = SiO_4(C_2H_3O)_4+4C_2H_3OCl.$$

The silico-acetic anhydride is a white crystalline body, very hygroscopic, and decomposed by water; under reduced pressure it may be distilled without decomposition; it fuses at 110°, and boils at ordinary atmospheric pressure at 170°, but is then decomposed. The formula of this body is $Si(C_2H_3O)_4$; alcohol decomposes this substance, with formation of acetic ether and deposition of silica.

Bulletin de la Société Chimique de Paris, September 1 and 15, 1872.

This number contains the following original papers and memoirs:—

Compounds of Yttrium and Erbium.—P. T. Clève and O. Hoeglund.—The first instalment of a monograph on this subject, divided into the following sections:—Introduction, containing a review of the labours of different *savants* on these metals, beginning with the discovery by Gadolin of yttria, in 1794, in a mineral named gadolinite; atomic weight of yttrium, estimated according to the method of Bahr and Bunsen, and found by the authors to be equal to 59·7 (O=16); atomic weight of erbium, equal to 113·7; oxide of yttrium; hydrate of yttrium; oxide of erbium; hydrate of erbium, $2(ErH_2O_2)+H_2O$; salts of yttrium; salts of erbium. This portion of the essay is elucidated by a large number of complex formulæ, and also contains the detailed description of a number of double salts of the metals.

Some Derivatives of Tetrachloride of Naphthaline.—E. Grimaux.—By heating, under pressure, pure tetrachloride, which fuses at from 179° to 180°, with water (30 parts to 1 of the tetrachloride) a compound is formed, which the author terms bichlorated naphthydrenic glycol, $C_{10}H_8Cl_2(OH_2)$, a solid crystalline substance, difficultly soluble in cold water, more soluble in boiling water, and readily soluble in alcohol and ether. With chloride of acetyl, this body yields a di-acetate, also a solid crystalline body—

$$C_{10}H_8Cl_2\left\{\begin{matrix}OC_2H_3O\\OC_2H_3O\end{matrix}\right.$$

soluble in alcohol and ether, and fusing at between 130° and 131°. With chloride of benzyl, the bichlorated naphthydrenic glycol yields a dibenzoate—

$$C_{10}H_8Cl_2\left\{\begin{matrix}OC_7H_5O\\OC_7H_5O\end{matrix}\right.$$

which, on being treated with alcoholic potassa solution, forms benzoic acid. When the bichlorated naphthydrenic glycol is distilled with hydrochloric acid, there is formed chlorated naphthol, $C_{10}H_8Cl,OH$, a solid body, soluble in boiling water, and fusing at 109°; the formation of this compound is explained by admitting that an intermediate compound chlorhydrine—

$$C_{10}H_8Cl_2\left\{\begin{matrix}Cl\\OH\end{matrix}\right.$$

$$C_{10}H_8Cl_2\left\{\begin{matrix}OH\\OH\end{matrix}\right.+HCl=C_{10}H_8Cl_2\left\{\begin{matrix}Cl\\OH\end{matrix}\right.+H_2O$$

is first formed; this intermediate chlorhydrine has not been isolated. The author devotes a large portion of this essay to a theoretical discussion on the formation of the chlorated naphthol. Treated with strong boiling nitric acid, the bichlorated naphthydrenic glycol yields a nitro-compound; with dilute nitric acid, phthalic acid is formed. By treatment with nitrate of silver, tetrachloride of naphthalin yields a solid yellow-coloured body, $C_{10}H_8Cl_2O_2$, insoluble in water, fusing at from 195° to 196°.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, July 4, 1872.

Extraction of Grease from Bones.—Lichtenberger.—The bones are first crushed, next treated with high-pressure steam, and to the semi-gelatinous mass thus formed is added hydrochloric acid (2 per cent), with which the material is boiled; by this operation the fat is separated and, floating on the top of the boiling liquor, is readily collected, and further purified by treatment with boiling water, a very small quantity of caustic soda having been added. Next, the grease (a fluid oil-like substance) is treated with animal charcoal, and, lastly, filtered.

Remarkable Instance of Disaggregation of Metallic Tin.—Dr. Oudemans.—It appears that a quantity of Banca tin was sent last winter by rail from Rotterdam to Moscow; on its arrival the metal was all converted into a powder, which, on being submitted to heat (somewhat above the fusion-point of the metal), did not become molten and re-converted to its pristine state, owing to the formation of a large quantity of oxide. Analysis proved the powder to be pure tin containing only 0·3 per cent of foreign metals (lead and iron). The author is of opinion that the blocks of tin were converted into powder by the combined action of cold and vibration during the journey by rail.

Process of Titration of Defecated Beet-Root Juice.—M. Vivien.—The author describes a method of testing beet-root juice for the purpose of ascertaining whether or not the excess of lime employed in the process of defecation of the juice has been properly removed from that liquor by the means industrially applied for that purpose. The author recommends the use of pure sulphuric acid, of which he takes 8·75 grms. to the litre of water; this solution is tinged red with a neutral tincture of litmus, and next diluted with 9 times its bulk of pure water. This liquid neutralises exactly its own bulk of clear defecated beet-root juice, when containing 5-10,000ths of lime. In order to test the beet-root juice, it is poured into a graduated tube made for the purpose, and the dilute sulphuric acid is added from a graduated pipette until a bright red colour is produced; if it is necessary to add an equal bulk of acid, the juice then contains ½ grm. of lime to the litre (equal to 5-10,000ths), but, if only required for the production of the red hue to, say, the third graduation of the tube, the juice still contains 2-10,000ths of lime.

Artificial Miniature Volcano.—Dr. Hochstetter.—After referring briefly to the well-known experiments of Lemery, the author states that when sulphur is molten under water by the aid of high pressure (3 atmospheres=45 lbs. to the square inch), the sulphur absorbs some water, which is next driven off when the sulphur cools down, and this emission of steam is accompanied by explosions and evolution of fumes, whereby in the sulphur, provided the quantity operated upon is sufficiently large (not less than 50 kilos.), an upheaving takes place, and formation of craters, as well as emission of molten sulphur, thus simulating lava.

Benzoic Acid in Ammoniacal Gas-Water.—H. Reidsch.—By first treating the gas-water at 50° with sulphate of lime, the carbonate of ammonia contained in that liquid is entirely decomposed, and there is obtained a solution of sulphate of ammonia strongly impregnated with tar compounds, which are separated with difficulty from the ammoniacal salts; but if the liquid is first evaporated at a gentle heat until all the water is expelled, and then further heated in a porcelain crucible covered with a small piece of mica, there is eliminated some benzoic acid in crystalline state, which adheres to the piece of mica.

Annalen der Chemie und Pharmacie, No. 11 and 12 (double number), 1872.

This number contains the following original papers and memoirs:—

Action of Sodium on Crystalline Dibrombenzol.—Dr. F. Riese.—The results of a series of experiments to ascertain the nature of the compounds which are generated by the action of sodium upon dibrombenzol.

On β-Dibrombenzol.—Dr. F. Riese.—This body in pure state is a clear, mobile, and refrangible liquid, exhibiting an aromatic odour, soluble in cold alcohol, ether, and benzol in every proportion, and not congealed at −27°; when converted into a mononitro-compound the author found that it is not identical with the dibrombenzol obtained by Kekulé, which fuses at 84°, while the former fuses at 58°, and distils over without alteration at 296°.

Observations on the so-called Anhydrides of Lactic Acid.—J. Wislicenus.—This exhaustive monograph, elucidated by complex formulæ and tables, is divided into the following sections:—Anhydrisation *(anhydrisirung)* of lactic acid at the ordinary temperature; anhydrisation of lactic acid at higher temperatures; the salts of the so-called anhydride of lactic acid; decomposition of the so-called lactic

acid anhydride by water. The results of these researches may be summarised as follows:—Before all the water present in a solution of lactic acid has been evaporated, some anhydride is present in the solution, and the quantity of that anhydride increases as the water decreases; pure lactic acid (formula $C_3H_6O_3$) does not therefore exist. When lactic acid is continuously kept in a dry atmosphere there is formed, even at the ordinary temperature, an anhydride and also a lactide. The author thinks it is probable that the lactic acids form a chemical compound with water in the same manner as acetic, formic, and valerianic acids, which form trihydrates corresponding to the formula:—

$$\begin{matrix} CnH_{2n}+1 \\ | \\ C-OH \\ | \\ C-OH \\ \diagdown OH \end{matrix}$$

and have a higher boiling-point than the monohydrates—

$$\begin{matrix} CnH_{2n}+ \\ | \\ C=O \\ \diagdown OH \end{matrix}$$

which, however, become partly decomposed by distillation, while water is eliminated *(abgespaltet)*.

On Bichlor-Ether.—Dr. H. Abeljanz.—This monograph is chiefly written to correct the labours of Lieben; it contains a large number of complex formulæ, and is divided into the following sections:—Introduction, treating on the preparation of the bichlor-ether, and on the products obtained by the action of dry hydrochloric acid gas upon aldehyde, and by the action of dry chlorine upon ethyl-ether; action of pentachloride of phosphorus upon bichlor-ether; decomposition of bichlor-ether; decomposition of bichlor-ether by alkali; general review of the results exhibited in a large number of lengthy and complex formulæ.

On Diphthalyl.—Dr. E. Ador.—This exhaustive essay treats on the preparation of diphthalyl by causing finely-divided metallic silver to act upon phthalyl chloride; the purified diphthalyl is a solid crystalline body, quite insoluble in water, scarcely soluble in alcohol and ether, but somewhat soluble in chloroform, sulphide of carbon, and fluid hydrocarbons; the best solvents for it are phenol and concentrated sulphuric acid; it fuses at 300°; its simplest formula is $C_8H_4O_2$. Action of alkalies upon diphthalyl; diphthalyl-aldehydic acid; diphthalyl acid; salts of this acid; capability of oxidation of diphthalyl acid; behaviour of diphthalyl-aldehydic and of diphthalyl acid in a higher temperature; action of pentachloride of phosphorus and of bromine upan diphthalyl; by-products of its preparation.

Some of the Cyanogen Derivatives of Aceton.—Dr. F. Urech.—It appears that the author, who briefly alludes to the labours of Morkownikoff, Städeler, Dr. Frankland, Duppa, and others on this subject, was desirous of preparing trimethylen-dicarbonic and dimethyl-malonic acids, starting from acetonic acid, first to be converted into α-brom-isobutyric acid. The monograph is divided into the following sections, all copiously elucidated by lengthy and complicated formulæ:—Action of anhydrous hydrocyanic acid, of nascent hydrocyanic acid, of cyanide of potassium, of cyanate of potassa, and of hydrochloric acid upon aceton; acetonyl-urea; splitting up of acetonyl-urea by acids; α-amido-isobutyric acid; hydrochloro-α-amido-isobutyric acid; synthesis of acetonyl-urea from its products of splitting up *(spaltungsproducten)* by the aid of acetonyl-uraminic acid; general review exhibited in a large number of formulæ.

Constitution of Sodium Ethylate.—A. Laubenheimer.—This paper treats more particularly on the constitutional formula of sodium ethylate, and the author states that, although otherwise agreeing with the excellent researches of Professor Wanklyn on this subject, the formula of sodium ethylate should be $C_2H_5.ONa$ instead of $C_2H_5Na.OH$.

Behaviour of Milk-Sugar with Permanganate of Potassa.—A. Laubenheimer.—The researches recorded in this essay were made partly to try whether it would be possible to obtain isomalic acid from milk-sugar, and partly to ascertain whether lactose is or is not completely oxidised, when in alkaline solution, by permanganate of potassa, it being premised that 1 molecule of milk-sugar requires for complete oxidation 24 atoms of oxygen—

$$C_{12}H_{12}O_{11},H_2O+24O=12CO_2+12H_2O.$$

The result of a series of experiments shows that lactose is slowly, but nearly completely, oxidised at the ordinary temperature, and rapidly at boiling heat of the solution, being entirely converted into carbonic acid and water. The formation of isomalic or malic acids from sugar of milk was not observed, but the author obtained carbonic and oxalic acids and an acid which, although not obtained in sufficiently pure state for analysis, appears to be akin to gallactinic and pectolactinic acids, the formulæ of which are, respectively, $2HO,C_{11}H_8O_7$ and $2HO,C_{16}H_6O_{10}$.

Presence of Benzyl Alcohol in Fluid Storax.—A. Laubenheimer.—After briefly referring to the researches made on storax by Bonastre, E. Simon, E. Kopp, Toel, Scharling, and others, and stating that storax, in addition to resins, contains styrol, C_8H_8, cinnamic acid, $C_9H_8O_2$, styracin (cinnamic acid-cinnamin ether), $C_9H_7(C_9H_9)O_2$, the author details some researches made with a preparation obtained by the saponification of impure styracin, and kept in the collection of chemical preparations of the University of Giessen. Among the products of a careful fractional distillation the author found a small quantity of benzyl alcohol, and also an alcohol, $C_9H_{12}O$, boiling at 243°, and cuminal alcohol, $C_{10}H_{14}O$.

Ethylic Ethers of Fumaric Acid.—A. Laubenheimer.—It appears that, when fumaric acid is heated with absolute alcohol under pressure to 120°, an ethylic ether of that acid is readily formed; this substance is in pure state a solid body, which, on analysis, was found to be the acid ether of the acid, or ethyl-fumaric acid—

$$C_4H_2O_2\begin{cases} OC_2H_5 \\ OH \end{cases}$$

This mode of its preparation is, however, attended with loss of material, and the author prefers to prepare it by passing hydrochloric acid gas into a boiling alcoholic solution of malic acid, but in that case the purification of the ether becomes rather a complicate affair.

Reduction-Products of Silicic Acid Ether, and on some of its Derivatives.—A. Ladenburg.—This exhaustive monograph is divided into the following sections:—General introduction and review of the labours of other *savants*; silicium-monethyl or silico-propion series; silicium-diethyl series; silicium-triethyl or silico-heptyl series; silicium-tetra ethyl series.

Nonylic Acid from the Octyl Alcohol of Heracleum Oil.—Th. Zincke and A. Franchimont.—After referring to their researches on heracleum oil and the alcohols therein contained, observing that the octyl alcohol present in the oil has also lately been discovered by Dr. L. van Renesse in the essential oil obtained from *Pastinaca sativa*, the authors treat on nonylic acid, $C_9H_{18}O_2$, in pure state a colourless oily fluid, boiling at 254°, sp. gr. at 17·5° = 0·9065, difficultly soluble in cold water, but slowly distilled over with the vapours of boiling water; at a low temperature nonylic acid becomes solidified, and then melts at 10°. The preparation of this acid from the octyl alcohol is given in detail, as is also the description of the salts which this acid forms with bases; the constitution of this acid is discussed at length, and there is added to that portion of the essay a tabulated form exhibiting the boiling-points of a series of acids belonging to the same series of bodies, and of their ethylic ethers.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, November, 1872.

This number contains no original papers relating to chemistry; we call attention, however, to the following memoirs:—

Report on a Modérateur Aspirateur Hygiénique to be Applied to Stoves and Heating Apparatus, and Invented by M. Henry.—H. Peligot.—The description, illustrated by engravings, of a simple and effective contrivance for carrying off the foul air from rooms where stoves are used, without creating a draught; the unpleasant odours of cooking operations are also discharged into the chimney.

Experiments made with Leaden Balls Discharged from Rifles.—Melsens.—A valuable contribution to balistics and the effects of leaden balls upon stone, brick, iron, soft substances, &c.

Preservation of Eggs.—A. Gaffard.—The fresh eggs are carefully placed in a mixture of 5 kilos. of alum dissolved in 5 litres of water, heated to from 45° to 50°, and left in that liquid for from thirty to forty minutes; the eggs are next drained, and in the meantime the solution of alum is heated to boiling-point. The eggs are again immersed in the liquid, and kept therein for from ten to fifteen seconds; after having been drained and cooled they are packed in either dry bran, sawdust, cork-dust, sifted ashes, or in cotton-wool, and may be kept fresh for a whole year.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 15, 1872.

This number contains the following original papers and memoirs:—

Coerulignon, a By-Product of the Manufacture of Wood-Vinegar.—C. Liebermann.—The substance designated as coerulignon is so called owing to its blue colour; it has recently been discovered during the process of purification of the crude wood-vinegar or pyroligneous acid in the factory of Th. Lettenmayer, near Königsbronn (Prussia). We intend to give a full translation of this paper.

Oxidation of Camphor Cymol in the Animal Body.—M. Nencki and E. Ziegler.—This paper records the results of experiments made upon dogs and men by administering doses of cymol prepared from camphor. The authors found in the urine, by a complicated process of purification, terephthalic acid and cuminic acid, being similar to the products of the artificial oxidation of these substances by chromic acid.

Products of Reduction of the Orthoformic Ether.—A. Ladenburg.—The result of the reduction of orthoformic ether by means of zinc-ethyl and sodium is, after a complicated process of operation, probably propional and a heptyl hydruret, $CH(C_2H_5)_3$, which the author calls triethyl-methan, a colourless liquid, exhibiting an odour somewhat like petroleum, boiling at 96°; sp. gr. at 27° = 0·689.

Application of Electrolysis to the Estimation of the Molecular Weight of Substances.—A. Ladenburg.—The contents of this paper are written to correct the views of Paterno (see Chemical News, vol. xxvi., p. 71).

Influence of Caoutchouc Tubing upon the Illuminating Power of Coal-Gas.—K. Zulkowsky.—The main results of the investigation may be summarised as follows:—(1). When it is intended to estimate the illuminating power of coal-gas, the gas should not be made to pass, before reaching the test-burners, through india-rubber tubing. (2). The decrease of the illuminating power is due to the absorption of the heavy hydrocarbons by the tubing material. (3). This behaviour of cautchouc should be borne in mind when analyses of coal-gas and similar gas mixtures are to be made.

Constitution of Camphoric Acid.—F. Wreden.—A preliminary notice. The author first refers to the researches of Chapman, Thorpe, Fittig, Baeyer, and others, and then states that, according to his

investigation, camphoric acid is a corresponding dimethyl-benzol homologue of Baeyer's hexahydrophthalic acid.

Contribution to the History of Bromide of Vinyl.—E. Fuchs.—Notwithstanding the high scientific value of this essay, its contents, elucidated by complex and lengthy formulæ, are not well suited for abstraction; an observation equally applicable to the following lengthy monograph:—

Affinity of Hydrogen to the Metalloids.—J. Thomsen.

(Meta ?)Chlorphenol and its Nitro-Derivatives.—A. Faust and H. Müller.—The preparation of monochlorphenol, by passing into pure molten phenol, is first described, and next the purification of the crude product. The pure monochlorphenol is a colourless oily fluid, not congealed below −15°, boiling at between 175° and 177°. It yields with nitric acid two isomeric mononitrochlorphenols; one of these—

$$C_6H_4[NO_2]ClO,$$

is partly an oily, partly a crystalline, body, fusing at 70°, difficultly soluble in water, but readily so in chloroform; it exhibits an odour like that of saffron, and forms crystalline salts with several bases; the other nitro-compound, $C_6H_4(NO_2)ClO$, is a solid crystalline body, fusing at 110° to 111°; it is identical with a chloronitrophenol obtained by Armstrong (*Journal of the Chemical Society*, x., 12, and *Zeitschrift für Chemie*, 1871, 591), and forms crystalline salts with several bases.

Chemical Processes which Obtain in Plants.—A. Emmerling.—Reserved for full translation.

Heptylic Acid from the Hexyl Alcohol of Heracleum Oil.—A. Franchimont.—After referring to some of his other researches on this subject, the author describes at length heptylic acid and several of its salts. The former is, at ordinary temperature, a colourless oily fluid, boiling at 223° to 224°; it solidifies at −18°, forming a crystalline mass, which becomes fluid at −8°; sp. gr. at 24° = 0·9212. Ethylic ether, prepared from the acid, absolute alcohol, and concentrated sulphuric acid, $C_7H_{13}(C_2H_5)O_2$; sp. gr. at 24° = 0·874; it boils at 187° to 188°, and is not solidified at −18°. Many of the salts of the heptylic acid are soluble only in strong alcohol.

Pentachlorbenzols.—A. Ladenburg.—This paper records a series of investigations for the purpose of controlling the statements by Jungfleisch and Otto. It appears that while the formulæ of both authors agree, there is a discrepancy as regards the boiling-points, and it would seem that there exists only one real pentachlorbenzol.

Dinitrobrombenzol and Phenyldiamin.—Th. Zincke and F. Sintenis.—This paper is not well suited for abstraction.

Some Derivatives of Diphenylmethan.—W. H. Doer.—Diphenylmethan, prepared by the action of finely-divided zinc upon benzyl chloride and benzol at boiling heat, is a crystalline body, exhibiting the smell of oranges, and fusing at 26°; it has been applied by the author for the preparation of—Dinitro-diphenylmethan—

$$C_{13}H_{10}(NO_2)_2,$$

a solid crystalline body, fusing at 183°; isodinitro-diphenylmethan, $C_{13}H_{10}(NO_2)_2$, also a crystalline body, insoluble in water, soluble in alcohol, ether, benzol, and acetic acid (glacial), fusing at 172°; tetranitro-diphenylmethan, $C_{13}H_8(NO_2)_4$; diamido-diphenylmethan—

$$C_{13}H_{10}(NH_2)_2;$$

diphenylmethan-disulpho acid, $C_{13}H_{10}(SO_3H)_2$; dinitro-benzophenon, $C_{13}H_8(NO_2)_2$; isodinitro-benzophenon, $C_{13}H_8(NO_2)_2O$.

This number contains a detailed account, written by A. Pinner, of the proceedings of the Chemical Section of the fiftieth annual meeting of the German Natural Philosophers and Physicians, held at Leipzig in August last; this meeting was very fully attended, and the proceedings bear testimony to the great progress made in chemical science in Germany. Many, if not all, of the papers read will be published *in extenso*.

NOTES AND QUERIES.

Oxychloride of Magnesium.—(Reply to T. F.)—The substance you allude to is not a cement, but a kind of artificial stone invented by Sorel. You will find ample information on the proper mode of preparing it in *Comptes Rendus*, vol. lxv., p. 102; *Mechanic's Magazine*, July, 1867, p. 52; *Dingler's Polytechnisches Journal*, Bd. 185, p. 292; and also in the Chemical News, vol. xxii.. p. 9.

Chemistry in India.—Mention was made in the Chemical News of India as a field for chemists to seek employment in. Could any of your readers inform me what work is there for a chemist to do? *i.e.*, whether under Government, or academical? also as to where and to whom application for such employment should be made?—Ph.D.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3017. N. Bickford, Exmouth, Devon, "An improvement in the manufacture of soap."—Petition recorded October 14, 1872.

3052. J. Hargreaves and T. Robinson, Wilnes, Lancashire, "Improvements in apparatus employed in the manufacture of sulphates of soda and potassa."

3057. J. J. Shedlock, Upper Holloway, Middlesex, "Improvements in apparatus for the treatment of hydrocarbon gases and vapours for illuminating and heating purposes."—Petitions recorded October 16, 1872.

3080. H. Bethel, Victoria Street, Westminster, "Improvements in the treatment of beer, in order to prevent and remove acidity."—Petition recorded October 18, 1872.

3094. E. C. Nicholson, Herne Hill, Surrey, "Improvements in the production of colours for dyeing and printing."

3095. A. P. Price, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of substances capable of being employed for the purposes of dyeing and printing."—Petitions recorded October 19, 1872.

NOTICES TO PROCEED.

1853. E. Abate, Naples, Italy, "Improvements in preserving food or organic substances, and also in the machinery or apparatus employed therein, parts of which machinery or apparatus are applicable for making ice, and for refrigerating purposes."—Petition recorded June 19, 1872.

1885. J. Horsley, Cheltenham, Gloucester, "An improvement in the manufacture of an explosive compound, and a new mode of firing explosive compounds."—Petition recorded June 22, 1872.

1905. W. E. Newton, Chancery Lane, "Improvements in the manufacture of vinegar, and in the acidulation or treatment of various liquids, and in the apparatus employed therein."—A communication from R. D. Turner and I. Vanderpool, New York, U.S.A.—Petition recorded June 24, 1872.

2046. E. P. H. Vaughan, F.C.S., Chancery Lane, "Improvements in the mode of utilising the waste gases of metallurgical and other furnaces."—A communication from F. Pernot, Paris, France.—Petition recorded July 6, 1872.

2487. W. Young, Magdalen Bridge, P. Brash, and A. Scott, Musselburgh, Midlothian, "Improvements in the destructive distillation of coal, shale, and other bituminous substances for the production of illuminating gas and of oils."—Petition recorded August 21, 1872.

2920. J. Saunders, and J. Piper, Cookley, near Kidderminster, Worcestershire, "Improvements in coating tin and terne plates, and in apparatus employed therein"—Petition recorded October 3, 1872.

3005. C. Lowe, Reddish, Lancashire, "Improvements in the treatment of coal-gas tars for the purpose of obtaining certain useful products therefrom."—Petition recorded October 11, 1872.

PATENTS SEALED.

1437. J. V. P. Lagrange, Boulevard de Strasbourg, Paris, "Improvements in the treatment of saccharine juices and syrups."—Dated May 11, 1872.

1454. T. Sheenan, Dunkirk, New York, U.S.A., "An improved process for steelifying iron."

1456. W. Clark, Chancery Lane, Middlesex, "An improved method of extracting anthracene contained in coal-tar and the pitch accruing therefrom, without either carbonising or decomposing the pitch."—Dated March 13, 1872.

1708. C. W. Harrison, and A. H. Harrison, High Holborn, Middlesex, "Improvements in the manufacture of gas for lighting and heating purposes, and in the apparatus employed therein."—Dated June 5, 1872.

2186. J. Thom, Chorley, Lancashire, and J. Stenhouse, Pentonville, London, "Improvements in treating fatty substances containing colouring matters, and in obtaining useful products therefrom."—Dated July 22, 1872.

FOREIGN PATENTS.

FRANCE.

95500. Boggio, "An alimentary product called 'fibrine.'"

95512. Jarosson and Muller-Pack, "A black aniline and other coal-tar dyes."

95517. Payne, "A composition for the manufacture of fire-bricks, crucibles, retorts, &c."

95522. The Aluminium Joint-Stock Company, "Obtaining double fluoride of sodium and aluminium (artificial cryolite), and double fluoride of aluminium and potassium."

95543. Gaffard, "Preserving eggs."

95557. Richard and Dupont, "Manufacturing soap-paste."

95558. Solway, "Improvements in the manufacture of carbonate and bicarbonate of soda and their sub-products, and apparatus belonging thereto."

95563. Anderson, "Improvements in treating skins or hides."

95578. Jones, "A mode of smelting or reducing iron oxides for obtaining the metal therefrom."

95581. Martin, "A direct process of puddling iron and other ores."

95586. Possoz, "Improvements in making and refining sugar."

95593. Unwin, "Improvements in the method or means of depositing nickel upon metals, and in the preparation of articles to be coated for the reception of the nickel coating."

95603. Digeon, "Applying the leaves and fruit of the carob tree."

95615. Knab, "A means of extracting successively all the useful substances from plants, wood, seeds, flowers, &c."

95625. Scala, "Improvements in indigo dyeing."

95656. Maderni, "Manufacturing so-called 'milk chocolate.'"

TO CORRESPONDENTS.

Delta.—It has not been isolated.

H. B.—We have often quoted the titles of books on the subject in our "Notes and Queries" or "To Correspondents" column.

THE CHEMICAL NEWS.

Vol. XXVI. No. 677.

ON THE

PRODUCTION OF FURFUROL BY THE ACTION OF HIGH-PRESSURE STEAM UPON WOOD.

By GREVILLE WILLIAMS, F.R.S.

My friend, Mr. George Fry, in the course of some laborious researches upon woody fibre, has had occasion repeatedly to subject fir wood to the action of water at an elevated temperature and pressure, and it is to him that I am indebted for the opportunity of examining some of the products. The experiments were each made on 100 lbs. of wood, in small blocks. They were placed in an iron cylinder surrounded with a steam jacket: 100 gallons of water were then introduced, and, the openings having been closed, high-pressure steam was admitted to the jacket until the manometer indicated a pressure of 100 lbs. to the inch in the interior of the cylinder. This was maintained for four hours. At the end of that time the liquid, which had become strongly acid, was run off through a cooling apparatus, and introduced into a rectifying still. By careful and repeated rectifications, two principal products were obtained in addition to the acid fluid: these were methylic alcohol and an oil.

The methylic alcohol was identified by conversion into oxalate of methyl.

The oil had a fragrant odour, resembling furfurol, but also recalling that of turpentine and cymene: 100 lbs. of wood yielded 10 ounces. Its specific gravity at 11° was 1·020. On rectification its boiling-point steadily rose from 163° to 216° C. On immersion in a freezing mixture it separated into two layers. The upper one was colourless, and had a specific gravity of 0·8855 at 11°; or, sensibly the same as that of turpentine. After rectification over sodium it yielded, on analysis, numbers intermediate between those of turpentine and cymene. Its odour also resembled that of a mixture of those substances. This hydrocarbon, or mixture of hydrocarbons, which is formed in very small quantity, is now under study. The lower layer had a specific gravity of 1·0784 at 11°. It gave the same reaction as furfurol with aniline. It was carefully rectified, and the portion boiling between 163° and 171° examined. On standing over sticks of potash a solid crust accumulated, which was separated by agitation. As thus obtained, the substance was in the form of minute colourless crystals: they were analysed with the following result:—

0·3473 grm. of substance gave 0·5072 grm. of carbonic acid, and 0·0770 grm. of water.

0·6140 grm. of substance gave 0·3606 grm. of sulphate of potassium.

Or, per cent—

	Experiment.		Calculation.		
Carbon ..	39·83	C_5	60·00	39·97
Hydrogen ..	2·46	H_3	3·00	2·00
Potassium ..	26·37	K	39·14	26·05
Oxygen ..	31·34	O_3	64·00	31·98
	100·00		166·14	100·00

The substance was, therefore, pyromucate of potassium, which is well known to be a product of the action of hydrate of potassium or pyromucic aldehyde (furfurol).

Although the conversion of the heavier oil into pyromucate of potassium might be considered sufficient evidence of its nature, I sought to confirm the result by the preparation of furfuramide, especially as such an experiment would enable me approximatively to determine the amount of furfurol present in the crude oil. On treatment with excess of strong ammonia, and allowing the mixture to stand for 12 hours, it was converted into a mass of straw-coloured needles. These were filtered off, pressed between folds of filtering-paper, and gently dried. After re-crystallisation from alcohol, the following numbers were obtained on analysis:—

0·2488 grm. of substance gave 0·6111 grm. of carbonic acid, and 0·1098 grm. of water.

	Experiment.		Calculation.		
Carbon ..	66·99	C_{15}	180	67·16
Hydrogen ..	4·90	H_{12}	12	4·48
Nitrogen ..	—	N_2	28	10·45
Oxygen ..	—	O_3	48	17·91
			268	100·00

The substance was, therefore, furfuramide. In order to obtain an idea of the amount of furfurol present in the oil, I made some experiments to determine the yield of furfuramide; the mean result of four experiments being that 100 parts of the crude oil gave 39·3 of furfuramide, corresponding to 42·3 per cent of furfurol.

Stenhouse, in the course of his admirable researches upon furfurol and its isomers, has shown that furfurol is formed on distilling sawdust with dilute sulphuric acid.* I have not, however, found any notice of its having been prepared by the action of water alone upon wood, and the fact of its production under these circumstances will probably tend to modify our views as to its derivation.

As the quantity of crude furfurol obtained in this manner will probably before long be very large, and as, from the nature of the process, it will all be saved, the process indicated will doubtless be the best source of furfurol at present known, until that which is produced in the preparation of munjeet and garancine is no longer allowed to escape.

Star Chemical Works, Brentford,
November, 1872.

RESEARCHES ON THE ATOMIC WEIGHT OF THALLIUM.†

By WILLIAM CROOKES, F.R.S., &c.

In June, 1862, and in February, 1863, I had the honour to lay before the Royal Society communications on the subject of the then newly discovered metal, thallium. In these I gave an account of its occurrence, distribution, and the method of extraction from the ore, together with its physical characteristics and chemical properties; also I discussed the position of thallium among elementary bodies, and gave a series of analytical notes.

In the pages of the *Journal of the Chemical Society* for April 1, 1864, I collated all the information then extant, both from my own researches and from those of others, introducing qualitative descriptions of an extended series of the salts of the metal. I propose in the present paper to lay before the Royal Society the details and results of experiments which have engrossed much of my spare time during the last eight years, and which consist of very laborious researches on the atomic weight of thallium.

Section I.

On the Determination of Atomic Weights.

In determining accurately the atomic weight of a metal that stands so high in the scale as thallium, difficulties and sources of error which are comparatively small with elements of low atomic weight are magnified to serious proportions, and require more than ordinary care for their elimination. When so large a proportion of the compound

* Watts's "Chemical Dictionary," vol. ii., p. 751.

† Abstract of a Paper communicated to the Royal Society, June, 1872.

under analysis or synthesis consists of the body itself whose atomic weight is the one unknown quantity, it is evident that the almost unavoidable errors occasioned by impurity in the materials employed, the losses incident to imperfect manipulation, or the inaccuracies arising during the weighing from the omission of the corrections required by temperature, pressure, &c., will all find their way into the number which is finally considered to represent the atomic weight of the metal.

I have attempted two entirely different methods of arriving at the atomic weight of thallium. Had the results of these determinations differed materially, I should have extended the research to other methods; but as they so nearly agree, it appeared unnecessary to incur so great an additional expenditure of time and material with no reasonable prospect of getting any but confirmatory results. The first method, and that which I shall describe, consists in taking a known quantity of metallic thallium, dissolving it in nitric acid, and weighing the nitrate of thallium produced.

The second method consists in dissolving known quantities of sulphate of thallium in water, and ascertaining how much nitrate of barium is necessary to precipitate the sulphuric acid as sulphate of barium.

Section II.

Apparatus Employed.

The absolute weight of any substance may be found from its apparent weight in an atmosphere of 30 inches of mercury, and from its apparent weight under, say, 25 inches of mercury. But the best weighings are undoubtedly one in air at ordinary pressure and temperature, and one in a highly rarefied atmosphere,—it cannot be said *in vacuo*, owing to the difficulty of working under such a difference of pressure between the atmosphere of the balance and that surrounding it.

The Balances.

Two balances were used. That which I shall call the *air*-balance was made by Messrs. Keissler and Neu expressly for this work, and will clearly indicate a difference of 0·0001 of a grain when loaded with 1000 grains in each pan.

The second balance, which I shall call the *vacuum* balance, is almost a duplicate of the first, of 14 inch beam, with agate knife-edges and planes, made by Oertling. It is enclosed in a cast-iron case connected with an air-pump, and so arranged that I can readily weigh any substance in air of any desired density, the rarefaction being measured by a barometer gauge.

At first it was attempted to put nearly the correct weight into the pan, and then make the final adjustment by means of the rider. It was, however, soon found that a nearer approach to accuracy is to introduce a certain weight, and then to alter the pressure of the air until the balance shows equilibrium. Two weighings at different degrees of atmospheric pressure, varying by a considerable interval, give data upon which to calculate what the weight would be in a perfect vacuum.

The Weights.

A set of weights as ordinarily supplied by even the best instrument makers is never absolutely exact; however carefully they may be adjusted, the pieces of metal which respectively represent 1000 grains, 100 grains, 10 grains, &c., are only more or less approximations to the true weights. In most chemical analyses, the error arising from such inaccuracies in the weights used is so small in comparison to errors of manipulation, or to imperfections inherent in the chemical processes adopted, that it may generally be disregarded; but when the chemist has for his object the determination of an atomic weight, or is engaged in other researches demanding the highest refinement of accuracy which chemistry and physics can supply, then he is bound to neglect no correction which will increase the precision of the results.

The weights I employed were of platinum, made expressly for these investigations by Messrs. Johnson and Matthey. The platinum was quite pure; it was fused, cast, and then well hammered. The weights were adjusted by myself during May, June, July, and August, 1864: they were first roughly adjusted, and then the sp. gr. of each weight was taken. The weights were heated to redness in a bath of magnesia previous to ascertaining their sp. gr. The density of the larger weights was ascertained to the second place of decimals, and that of the smaller ones to the first place. The following are the results of the final adjustment, the weight *in vacuo* being calculated by the formula:—

W = weight in air,
w = weight in water,
a = sp. gr. of air as compared with water;

then—

$$x = \text{weight } in\ vacuo = \frac{W - aw}{1 - a},$$

where $a = 0{\cdot}001225$, and
$1 - a = 0{\cdot}998775$.

Results of the Adjustment of Standard Grain-weights (Platinum set).

Weights.	True Value in Air 30 in. 62° F.	Weight of Air displaced.	Volume in Water of Max. Density.
grs.	grs.	grs.	grs.
1000·	1000·000000	0·058271	47·51
600·	599·998340	0·035533	28·97
300·	300·000240	0·017501	14·27
200·	199·998910	0·011664	9·51
100·	99·991420	0·005887	4·80
60·	59·993232	0·000483	2·84
30·	29·999991	0·001668	1·36
20·	19·999984	0·001104	0 90
10·	9·998477	0·000490	0·40
6·	5·998268	0·000355	0·29
3·	3·000469	0·000171	0·14
2·	1·999839	0·000113	0·10
1·	0·998980	0·000055	0·04
·6	0·602350	0·000035	0·03
·3	0.303600	0·000017	0·02
·2	0·203240	0·000011	0·01
·1	0·098110	0·000005	0·004
·06	0·061472	0·000003	0·003
·03	0·030561	0·000002	0·002
·02	0·022884	0·000001	0·001
·01	0·014097	0·000001	0·0004
*·01′	0·009997	0·000001	0·0004
*·01″	0·009967	0·000001	0·0004

* Riders.

The value of each weight in air, plus the weight of air displaced, is, of course, the weight *in vacuo*.

The Glass.

The flasks and vessels used were of the hardest Bohemian glass, and as thin as they could be employed. When practicable, vessels of old green German glass were used; neither this nor Bohemian glass is practically affected by reagents.

No cork or luting was employed in the distillations, &c.; in most cases the apparatus was blown in one piece, and the operations performed in a vacuum. The apparatus, which was weighed, was entirely composed of glass suspended with platinum wire loops: fingers were never allowed to touch it after the first weighing.

The weight of tubes, bulbs, and flasks, even of hard Bohemian glass, constantly diminishes when the glass is long heated in a spirit- or gas-flame; this loss may amount to several thousandths of a grain in the space of two hours when a bulb of Bohemian glass 3 inches in diameter is exposed to a decided red heat in a gas flame. Following the suggestion of Professor Stas, I have obviated this source of error by employing a bath of pure magnesia; and I find that the weight remains constant even at a nearly white heat. I have likewise employed baths of lime with similar satisfactory results.

The special apparatus that I have used are described in the processes in which they were required; I need scarcely say that in no case were materials of untried purity employed.

Improved Sprengel Vacuum Pump.

Before detailing the processes of the determination, it will be requisite to describe the means of producing a vacuum in the flasks and bulbs employed. In proceeding with the determinations, several additions and improvements have been made to the Sprengel pump as generally found in the laboratory. The apparatus, as thus arranged, is readily manageable, with certainty of obtaining a Torricellian vacuum.

SECTION III.

The Chemicals.

The detail of the processes of preparing the thallium and the reagents in a chemically pure state is too necessary to admit of useful abstraction.

SECTION IV.

Processes and Results.

The processes and manipulation necessary to the determination of an atomic weight are at all times difficult and delicate, but especially in the case of a metal such as thallium, so readily oxidisable. This strong tendency to combine with oxygen renders the ordinarily exact processes of weighing out pure metals inapplicable to the present purpose. The chances of contact with the oxygen of the atmosphere must be reduced to a minimum, and to this end it was found desirable to work *in vacuo*. For this purpose the series of bulbs shown in Fig. 11 have been blown. Pure thallium is introduced into *a*, the upper end of which is then sealed. The end *c* is also sealed up, and the horizontal tube *e* is connected to the Sprengel pump, and a vacuum obtained, the tube being then sealed at *f*. The thallium in *a* is now heated on a magnesia-bath to its point of fusion (561° F.), and when molten caused, by gently tilting the vessel, to flow by the narrow channel *d* into the lower bulb *b*, all oxide remaining in *a*. The channel *d* is now contracted before the blowpipe, and *a* removed. The bulbs then appear as in Fig. 12, and after cooling are carefully weighed in air and *in vacuo*. The fine point of a blowpipe-flame, caused to impinge upon the end of the tube at *g*, softens the glass, and the air, endeavouring to force its way into the bulbs, forms a capillary orifice. By heating the bulb, and immersing the orifice in the pure nitric acid, the acid is introduced into the bulbs *h* and the globe *b* until all the thallium has been dissolved. The most tedious part of the process then commences, the evaporation of the excess of free acid. For this purpose an apparatus is used of the form represented in Fig. 13: *a* is the apparatus, connected by a wide tube (*b*) and a narrower glass tube with a Woulfe's bottle (*c*); this is in connection with a Bunsen's water pump (*d*), having 15 feet fall of water, and capable of producing an exhaustion equal to 10 inches of mercury. In the course of time the nitrate of thallium is left in the form of dry white crystals. The pump is then stopped, and air allowed to enter the apparatus by opening the pinch-cock, *e*, connected with the chloride of calcium tubes, *f*. The nitrate of thallium is then treated with a solution of oxalic acid to reduce any pernitrate that may be formed, the crystals dried, fused, dissolved in water, again allowed to crystallise, the evaporation of the water being repeated under diminished pressure. When there is no longer a loss of weight, the nitrate of thallium is finally weighed, the air being exhausted from the apparatus. The apparatus is now of the form shown in Fig. 14, and is weighed at two different atmospheric pressures. The nitrate of thallium having been afterwards removed, the apparatus is alone weighed at two different pressures. There have thus been obtained:—

α. The weight of the glass + thallium.
β. The weight of the glass + nitrate of thallium.
γ. The weight of the glass alone.

Particulars of these weights are given in the next section.

SECTION V.

Calculation of the Results.

The formulæ by which I have calculated the weights from weighings at two different atmospheric pressures are given at length in the full description of the processes that I have the honour to submit to the Royal Society.

Collecting the data, we have:—

	grs.
True weight of thallium *in vacuo* ..	= 183·790232
True weight of nitrate of thallium *in vacuo*	= 239·646065
True weight of glass	= 766·133831
(*a*) Weight of thallium according to true value of weights in air ..	= 183·783921
(*b*) Weight of nitrate of thallium in air (1005·425937 − 765·814578)	= 239·611359
(*c*) Weight of glass &c. in air	= 765·814578
Weights employed to balance (*a*) ..	= 183·8099
Weights employed to balance (*b*) (1005·4364 − 765·8081)	= 239·6283
Weights employed to balance (*c*) ..	= 765·8081

The reduction of the atomic weight from these data becomes a case of simple proportion; but the values found are absolute in so far only as the atomic weights of nitrogen and oxygen are correct. The atomic weights of nitrogen and oxygen have been usually represented by the numbers 14 and 16; but Professor Stas found these elements represented, according to observation, by—

Oxygen (O_3)	= 47·880
Nitrogen	= 14·009

or nitric acid $NO_3 = 61·889$. According to the old equivalents, $NO_6 = 62$.

Taking as data the series of weighings *in vacuo*, the quantity of nitric acid required to convert the thallium into nitrate is (239·646066 − 183·790232 =) 55·855834 grs.

We have, then, with Professor Stas's determination of the atomic weights of nitrogen and oxygen, the following proportion:—

Weight of Nitric Acid.		Weight of Thallium.		Atomic Weight of Nitric Acid.		Atomic Weight of Thallium.
55·855834	:	183·790232	::	61·889	:	x;

$\therefore x = 203·642$.

Let us see what would be the atomic weight of thallium if one or other of the corrections introduced into the above determinations had been omitted. The use of the old equivalent (= 62) for nitric acid, with the data derived from the weighings *in vacuo*, gives—

55·855834 : 183·790232 :: 62 : 204·007

as the atomic weight; but I cannot admit this number to be so nearly correct as 203·642.

If we take the corrected weighings in air of ordinary density, we have, with $NO_3 = 61·889$,

203·738.

With $NO_6 = 62$,

204·103.

Accepting the uncorrected weights, observed in air, we have with $NO_3 = 61·889$,

203·162.

With $NO_6 = 62$,

204·165.

The error of the last deduction, +0·523, is sufficiently large to show the necessity of neglecting no precaution in chemical manipulation, especially in a determination of this character. The largeness of these errors have an immediate bearing upon quantitative analysis; for they show that from data ordinarily given very varying results may be obtained. Chemists have to deal with much smaller quantities than a quarter per cent, particularly in organic analysis, where such a difference from the truth may lead to very erroneous reasoning.

RESULTS.

Ten results of the most trustworthy weighings (with $NO_3=61{\cdot}889$) are*:—

Determination.	True Weights *in vacuo*. Weight of Thallium taken.	Weight of Nitrate of Thallium + Glass.	Weight of Glass.	Calculated Atomic Weight from these data.
	grs.	grs.	grs.	grs.
A.	497·972995	1121·851852	472·557319	203·666
B.	293·193507	1111·387014	729·082713	203·628
C.	288·562777	971·214142	594·949719	203·632
D.	324·963740	1142·569408	718·849078	203·649
†E.	183·790232	1005·366796	766·133831	203·642
F.	190·842532	997·334615	748·491271	203·636
G.	195·544324	1022·176679	767·203451	203·639
H.	201·856345	1013·480135	750·332401	203·650
I.	295·683523	1153·947672	768·403621	203·644
K.	299·203036	1159·870052	769·734201	203·638

I wish it to be noted that I have made determinations with various weights of thallium. In ordinary analysis chemists are satisfied to take 5 or 10 grains of the substance under investigation: here I have gone to the very highest weight that can be entrusted with safety to the balance. The lowest weight of thallium taken is 183·790232 grains, the heaviest 497·972995 grains, the remaining determinations varying between these limits. It is hardly necessary to say that the purpose has been to eliminate the error arising from manipulation with small quantities, and to produce such variety in the results as renders the chances of coincidence of very small value.

Let me now tabulate the results of the determinations, with the view to ascertain severally their degree of approximation to the arithmetic mean:—

A.	203·666	+0·024
B.	203·628	−0·014
C.	203·632	−0·010
D.	203·649	+0·007
E.	203·642	+0·000
F.	203·636	−0·006
G.	203·639	−0·003
H.	203·650	+0·008
I.	203·644	+0·002
K.	203·638	−0·004

The arithmetic mean of the ten observations is

$$a=\frac{2036{\cdot}424}{10}=203{\cdot}642.$$

The probable error is 0·0022; and the probability that the true value lies between 203·632 and 203·652 is 0·99808, certainty being represented by unity.

I may therefore conclude that the atomic weight of thallium is, within the limits of error (as small as possible) of observation,—

203·642

Professor Stas has shown the hypothesis of Prout—that the atomic weights of the elements are severally multiples of the atomic weight of hydrogen—to be without the corroboration of experimental result. This view of the hypothesis is further borne out in the present investigation; for the number 203·642 cannot, within the limit of what has been shown to be the probable error, by any liberty be made to follow the hypothesis. Without doubt, when the atomic weights of all the metals are re-determined according to the standard of recent scientific method, it will be found that there are more exceptions to the hypothesis than commonly considered. Marignac gives, in his confirmatory discussion of Stas's experiments, and in his own results with calcium (40·21), lanthanum (94·13), strontium (87·25), analogous opposed evidence, as in the case of the weight found for thallium.

I have thus striven to eliminate all erroneous influence in the number I submit to the Royal Society as the atomic weight of thallium; and I shall be amply rewarded for my long labour if I can know that the determination has secured to researches of this character a nearer approach to the standard of truth.

The drawings appended to the complete paper comprise copies of:—

Fig. 1. The case of the vacuum balance.
2. The improved Sprengel vacuum pump.
3. Apparatus for preparing pure water under diminished pressure.
4. Apparatus for preparing nitric acid under diminished pressure.
5. Apparatus for preparing oxalic acid under diminished pressure.
6. Apparatus for preparing sulphuric acid under diminished pressure.
7. Stoppered tube in which thallium was weighed in the early determinations.
8. A series of bulbs.*
9. Another series of bulbs.*
10. Apparatus for sealing up thallium in hydrogen.
11. The first stage of selected glass apparatus.*
12. The second stage of selected glass apparatus.*
13. The Bunsen water pump and drying apparatus.
14. The third stage of selected glass apparatus.*

SOLVENTS FOR INDIGO.

By Dr. E. JACOBSEN.

SOME new solvents for indigo have lately been given by De Aguiar and Baeyer, and by Professor Wartha. To these I will also add a few which I have discovered. That aniline will dissolve indigo has been known several years, from my own experiments; but an equally good solvent for indigo is nitrobenzol, which, when heated with indigo, is coloured a deep violet-blue, and on cooling deposits flaky crystals, and then appears dark red, probably from red indigo.

In greater or less quantities, the following substances dissolve indigo at their boiling-points:—

Castor oil, acetone, hydrate of chloral, camphor, oil of turpentine, balsam of copaiba, cedar oil (oil of Juniper virgin), amylic alcohol, oil of lavender, white bees'-wax, Japanese vegetable wax, and Carnauba wax (from this last small flaky crystals precipitate).

The higher the boiling-point of the solvent, the redder is the appearance of the solution; so that bodies like acetone, amylic alcohol, and hydrate of chloral give a clear blue. Castor oil, cedar oil, &c., a violet-blue, and the different kinds of wax a purple-red solution. If kept for a short time at the boiling-point with white wax, the colour changes from scarlet to orange, and at last to a brown. The indigo is reduced by the formation of acrolein, and the solution retains its brown colour even on the addition of gasoline.

If powdered indigo is added to melting picric acid, the former will be decomposed with deflagration.—*American Chemist.*

University of London.—The following are lists of the candidates who have passed the recent second B.Sc. Examination:—*First Division.* Edward Albert Butler, B.A., private study; Charles Callaway, M.A., Cheshunt College; John Henry Poynting, Owens College; Ebenezer Geer Russell, First M.B., Guy's Hospital; Robert Harold Ainsworth Schofield, B.A., Lincoln College, Oxford, and Owens.—*Second Division.* Robert William Atkinson, University College and Royal School of Mines; Thomas Carnelley, Owens College; Alexander Irving, B.A., private study and School of Mines; Henry Elthington Price, private study.

* It should be noted that the arithmetic mean of *all* the readings, including the highest as well as the lowest result, in which doubt might arise as to success in manipulation, is 203·6.

† Fully illustrated in the paper.

* For the conversion of thallium into nitrate of thallium,

ON THE ECLIPSE EXPEDITION, 1871.*

By J. NORMAN LOCKYER, F.R.S., M.R.I.

(Concluded from p. 226).

I MUST now state very briefly some of the results of our work; and first, the certain results.

We were able to make out the structure of the corona. We know all about the corona so far as the structure of its lower brighter strata, that portion, viz., which I referred to in my lecture last year as being visible both before and after totality, is concerned. You may define it as consisting of cool prominences; that is to say, if you examine a prominence any day, without waiting for an eclipse, and then go to an eclipse and examine the lower portion of the corona, you will find the same phenomena, *minus* the brightness. You find the delicate thread-like filaments which you are now all so familiar with in prominences—filaments which were first thrown on a screen in this theatre; the cloudy light masses, the mottling, the nebulous structure, are all absolutely produced in the corona, as far as I could see it with a telescope with an aperture of 6¼ inches; and I may add that the portion some five minutes round the sun reminded me forcibly in parts of the nebula of Orion, and of that surrounding η Argus, as depicted by Sir John Herschel, in his Cape observations.

We have shown that the idea that we did not get hydrogen above 10 seconds above the sun is erroneous; for we obtained evidence that hydrogen exists to a height of 8 or 10 minutes at least above the sun; and I need not tell you the extreme importance of this determination. One of the proofs we have of that lies in this diagram, showing the observations made by Professor Respighi, armed with an instrument the principle of which I hope you are now familiar with.

Just after the sun disappeared, Professor Respighi employed this prism to determine the materials of which the prominences which were then being eclipsed were composed; and he got the prominences shaped out in red, yellow, in blue, and in violet light, a background of impure spectrum filling the field; and then, as the moon swept over the prominences, these images became invisible. He saw the impure spectrum and the yellow and violet rings gradually die out, and then three bright and broad *rings*, painted in red, green, and blue, gradually form in the field of view of his instrument; and as long as the more brilliant prominences were invisible on both sides of the sun, he saw these magnificent rings, which threw him in a state of ecstacy. And well they might.

These rings were formed by C and F, which shows us that hydrogen extends at least 7 minutes high, for had we not been dealing with hydrogen we should have got a yellow ring as well, because the substance which underlies the hydrogen is more brilliant than the hydrogen itself, and in addition to the red ring and the blue ring, which indicate the spectrum of hydrogen, he saw a bright green ring, much more brilliant than the others, built up by the unknown substance which gives us the Kirchhoff line, 1474.

Now, at the time that Professor Respighi was observing these beautiful rings by means of a single prism and a telescope of some 4 inches aperture, some 300 miles away from him—he was at Poodocottah, and I was at Bekul—I had arranged the train of prisms which you see here so that the light of the sun should enter the first one, and after leaving the last one should enter my eye. And what I saw is shown, side by side with Respighi's observations, in this diagram, in which I have separated the rings somewhat, so that there should be less confusion than in the actual observation. Here is Professor Respighi's first observation. He gets indications of C, D^3, F, and the hydrogen line near G. He was observing the very lowest, brightest region of all, and therefore 1474 was obliterated by the brightness of the continuous spectrum; but, as the eclipse went on, D^3 was entirely obliterated, and afterwards he got C and F building up rings together with 1474, which was not represented in the lower regions of the prominence—not because it was not there, but because, as I have already insisted, of the extreme brilliancy of the background. Now my observation was made intermediately, as it were, between the two observations of Professor Respighi's. Let me show the observations together.

Respighi ..	C	D^3	F	G	Prominences at beginning of eclipse.
Lockyer ..	C	1474	F	G	Corona at 80 seconds from commencement.
Respighi ..	C	1474	F		Corona at mid eclipse.

Note that I had no object-glass to collect light, but that I had more prisms to disperse it; so that with me the rings were not so high as those observed by Respighi, because I had not so much light to work with: but such as they were I saw them better, because the continuous spectrum was more dispersed, and because, with my dispersion, the rings—the images of the corona—therefore did not so much overlap. Hence, doubtless Respighi missed the violet ring which I saw, so faint, however, that both that and 1474 were almost invisible, while C shot out with marvellous brilliancy, and D^3 was absent.

These observations thus tend to show, therefore, that instead of the element—the line of which corresponds with 1474—existing alone just above the prominences, the hydrogen accompanies it to what may be termed a great height above the more intensely heated lower levels of the chromosphere, including the prominences in which the lower vapours are thrown a greater height. With a spectroscope of small dispersion attached to the largest mirror of smallest focus which I could obtain in England, the gaseous nature of the spectrum, as indicated by its *structure*, that is, bands of light and darker intervals, as distinguished from a continuous spectrum properly so called, was also rendered evident.

These are results of the highest importance, which alone are worth all the anxiety and labour connected with the expedition.

But there is more behind.

The photographic operations (part of the expense of which was borne by Lord Lindsay) were most satisfactory, and the solar corona was photographed to a greater height than it was observed by the spectroscope, and with details which were not observed in the spectroscope.

Mr. Davis was fortunate enough to take an admirable series of five photographs at Bekul, and Captain Hogg also obtained some at Jaffna; but I am sorry to say the latter lack somewhat in detail.

I have prepared two lamps, because I am anxious to exhibit the photographs two at a time, that you may compare one with the other. [This was done.] You see that, so far as the camera goes—and mark this well—the corona was almost changeless during the whole period of totality; this is true, not only for one place, but for all the places at which it was photographed.

I now exhibit two other photographs—one taken at Jaffna, and the other at Ootacamund. Actinically, the corona was the same and practically changeless at all the stations. You see that, though not so obvious as in the other case, there is the same similarity.

Before I leave the actinic corona, I am anxious to show you an image of it, taken during the American eclipse of 1869 in a camera exposed to the sun during the whole of the totality; to a certain extent, in our recent photographs we have reproduced what was photographed in 1869.

The solar nature of most, if not all, of the corona recorded on the plates is established by the fact that the plates, taken in different places, and both at the beginning and end, of totality, closely resemble each other, and much of the exterior detailed structure is a continuation of that observed in the inner portion independently determined by the spectroscope to belong to the sun.

* A Lecture delivered before the Royal Institution of Great Britain,

While both in the prism and the 6½ inch equatorial the corona seemed to form pretty regular rings round the dark moon, of different heights according to the amount of light utilised by the instrument, on the photographic plates, the corona, which, as I have before stated, exceeds the limits actually seen in the instrument I have named, has a very irregular, somewhat stellate outline, most marked breaks or rifts (*ignored by the spectroscope*), occurring near the sun's poles, a fact perhaps connected with the other fact that the most active and most brilliant prominences rarely occur there.

From the photographs in which the corona is depicted actinically, we pass to the drawings in which it is depicted visually. I would first call attention to two drawings made by Mr. Holiday, who formed part of the expedition, and in whose eye everyone who knows him will have every confidence.

First there is a drawing made at the commencement of the totality, and then a drawing made at the end. There is a wonderful difference between the drawings; the corona is in them very much more extensive than is represented actinically on our plates.

Here is another drawing, made by Captain Tupman, in which again we have something absolutely different from the photographs and from Mr. Holiday's sketches, inasmuch as we get an infinite number of dark lines extending down to the moon, and a greater extension than in the photographs, though in radial places the shape of the actinic corona and some of its details are shown.

Now the corona, as it appeared to me with the naked eye, was nothing but an assemblage of bright and dark lines: it lacked all the structure of the photographs, and appeared larger; and I have asked myself whether these lines do not in some way depend on the size of the telescope, or the absence of a telescope. It seems as if observations of the corona with the naked eye, or with a telescope of small power, may give us such lines; but that, when we use a telescope of large power, it will give, close to the moon, the structure to which I have referred, and abolish the exterior structure altogether, leaving a ring round the dark body of the moon such as Professor Respighi and myself saw in our prisms; and in the 6 inch telescope, in which the light was reduced by high magnification, so as to bring the corona to a definite ring some 5 minutes high; while Professor Respighi, using a 4 inch telescope and less magnifying power, brought the corona down to a ring something like 7 minutes high.

And here we have an important connection between spectroscopic and telescopic work. If we employ a telescope in which the light is small or is reduced by high magnification, we bring the corona to a definite ring, and perhaps here we have the origin of the "ring-formed" coronas.

Many instances of changing rays, like those seen by Plantamour in 1860, were recorded by observers in whom I have every confidence. One observer noted that the rays revolved and disappeared over the rifts.

We have next to deal with the polariscopic observations.

Mr. Lewis, in sweeping round the corona at a distance of 6′ or 7′ from the sun's limb, using a pair of compensating quartz wedges as an analyser, which remained parallel to itself while the telescope swept round, observed the bands gradually change in intensity, then disappear, bands of a complementary character afterwards appearing, thereby indicating radial polarisation.

Dr. Thompson at Bekul saw strong traces of atmospheric, but none of radial, polarisation, with a Savart. With the same class of instrument the result obtained by myself was precisely similar; while on turning in the Biquartz, at the top and bottom of the image of the corona, *i.e.*, near the sun's equator, faint traces of radial polarisation were perceptible for a short distance from the moon's limb. Captain Tupman, who observed with the polariscope after totality, announces strong radial polarisation extending to a very considerable distance from the dark moon.

Leaving the extreme outside of the corona as a question to be determined at some future time—and it can well wait—let us come to the base of the corona, and deal with the region to which I have already referred, close to the sun.

What was the general conclusion at which we arrived on this important point? Before I state it, let me tell you the instrumental conditions of the inquiry. We can use such a spectroscope as the one with which you are all familiar, and so arrange matters that the slit shall be carried by a clock, so that it may follow accurately the edge of the moon; but if the least variation in the rate of motion takes place, the observation is rendered almost valueless. But if we employ a spectroscope in which we sum up the light—do not localise the light, but throw it together—it does not matter whether your clock goes well or not, you are certain to have a result worthy of credit. But if you employ such an instrument as Professor Respighi employed, and abolish the slit altogether, the weight of any observations made with such conditions is very great.

Captain Maclear, who was observing with me at Bekul, has undoubtedly shown that, when the light of our atmosphere is cut off by the interposition of the dark moon, we see very many more bright lines than we do when this is not the case, the lines being of unequal height.

Mr. Pringle, also at Bekul, showed that at the end of totality many lines flashed into one of these instruments, carried under these difficult conditions.

Captain Fyers, the Surveyor-General of Ceylon, observing with a spectroscope of the second kind, saw something like a reversal of all the lines at the beginning, but nothing of the kind at the end.

Mr. Fergusson, observing with a similar instrument, saw reversal neither at the beginning nor the end.

Mr. Mosely, whose observations are of great weight, says that at the beginning of the eclipse he did not see this reversal of lines, Whether it was visible at the end he could not tell, because at the close the slit had travelled off the edge of the moon.

Professor Respighi, using no slit whatever, and being under the best conditions for seeing the reversal of the lines, certainly did not see it at the beginning, but he considers he saw it at the end, though about this he is doubtful.

From the foregoing general statement of the observations made on the eclipse of last year, it will be seen that knowledge has been very greatly advanced, and that most important data have been obtained to aid in the discussion of former observations. Further, many of the questions raised by the recent observations make it imperatively necessary that future eclipses should be carefully observed, as periodic changes in the corona may then possibly be found to occur. In these observations the instruments above described should be considered normal, and they should be added to as much as possible.

I had intended, if time had permitted me, to point out how much better we are prepared for the observation of an eclipse now than we were when we went to India, and how a system of photograph record should be introduced into the spectroscopic and polariscopic work; but time will not allow me to do more than suggest this interesting topic. I am anxious, however, that you should allow me one minute more to say how very grateful we feel for the assistance rendered by all we met, to which assistance so much of our success must be ascribed. I wish thus publicly to express the extreme gratitude of everyone of our Expedition to the authorities in India and in Ceylon for the assistance we received from them; and our sorrow that Admiral Cockburn, a warm and well-known friend to science, who placed his flag-ship at the disposal of the expedition, and the Viceroy, whose influence in our favour was felt in every region of India whither our parties went, and to whom we gave up our ship, are now, alas! beyond the expression of our thanks. We are also anxious to express our obligations to the directors and officers of

the Peninsular and Oriental Company for the magnificent way in which they aided us. If they had not assisted us as they did, science would have gained very much less than she has done from the observations of the last eclipse.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 7th, 1872.

Prof. Williamson, Vice-President, in the Chair.

When Messrs. R. Weaver, C.E., W. W. Fisher, Edward Kinch, and Walter Weldon, had been formally admitted Members of the Society, and the donations announced, the following names were read for the first time:—Messrs. Kigonari H. Yoshida, Francis H. Hobler, Sydney Lupton, E. W. Prevost, Ph.D., Thomas Williams, T. D. Fitmal, Joseph Lainson Wills, A. Percy Smith, Philip Braham, John Hollings Mitchell, Robert William Jones, A. Cameron Bruce, M.A.

For the third time—Archibald Liversidge, Esq., who was ballotted for and duly elected.

The first paper was "*On the Action of Charcoal on Organic Nitrogen*," by E. C. Stanford. The author, in 1869, proposed a method of mixing excreta, fish offal, and other offensive matter, with charcoal, so as to deodorise them, and when dry to heat the product in retorts, thus obtaining the whole of the nitrogen as ammonia. Experiments were made to ascertain the truth of the current opinion that nitrogenous matters in contact with charcoal become oxidised, giving rise to nitric acid, which would of course render the process valueless. For this purpose mixtures of excreta and decaying animal matter with three different varieties of charcoal were prepared, and examined at different intervals during twenty-one months, but no nitric acid could be detected. The author therefore infers that charcoal mixed with nitrogenous organic matter acts simply as a dryer, and not as an oxidising agent, and that for all practical purposes there is but little loss of nitrogen in such mixtures.

The Chairman said it was interesting to find, from the records of the author's experiments on this important point, that the loss of nitrogen was so small. This method would doubtless be of great practical importance, especially as those products of oxidation generally believed to be formed by the action of the air did not occur.

There was also another short paper by Mr. E. C. Stanford, "*On Iona Pebbles*." These pebbles, of which analyses are given, are a variety of non-aluminous serpentine, of an olive-green colour.

Prof. Maskelyne observed that not only the pebbles mentioned, but also other Iona minerals, had already been analysed, and the results published in the *Journal* of the Society.

The Chairman called the attention of the members to a beautiful specimen of bromocamphor made by Mr. Williams, which was remarkable as having been prepared at the ordinary pressure.

Mr. Williams said it was only necessary to keep the mixture of bromine and camphor at 130°, and, when the action was complete, to dissolve the crude substance in hot petroleum. On cooling the bromocamphor crystallised out, and the camphor remained in solution. Two or three crystallisations from alcohol rendered it pure. The large amount of hydrobromic acid given off rendered it much safer to operate at the ordinary pressure than in closed vessels. The speaker added that it was used medicinally, as a nerve sedative, in such diseases as *delirium tremens*.

A communication entitled "*Mineralogical Notices*," by Prof. Story Maskelyne and Dr. Flight, was then read by the former. There were many specimens in the British Museum which were unique or almost so, and it was desirable to have them analysed, to ascertain what they really were, so as to discover, if possible, new localities for them, or, if they were not definite minerals, to abolish them. The first mentioned was isopyre, of which there were several specimens, varying in appearance but differing considerably in composition: probably the presence of ferrous oxide in all these varieties of opal may explain the mineralogical similarity to which their association, under the name of isopyre in our collections, is due.

A mineral named Percylite, after Dr. Percy, originally from Sonora, in Mexico, has also been obtained from another locality, namely, South Africa. That from Sonora had a notable amount of gold disseminated throughout the specimen, whilst the one from Africa contained horn silver. The author had also procured from South Africa a mineral of a chestnut-brown colour, which turned out to be remarkably pure vanadite. He also noticed some new Cornish minerals, a uranite from Redruth, and a specimen of a remarkable bluish-green, botryoidal, lustrous mineral, associated with quartz: on examination it was found to have the composition of prasine or ethlite, a member of the pseudo-malachite group, one of which—the normal pseudo-malachite—contains three equivalents of cupric hydrate, the others one or more equivalents of water substituted for the same number of equivalents of cupric hydrate.

Dr. Williamson thanked the authors for their valuable instalment of mineralological notices from the British Museum, and remarked that it was especially pleasant to chemists to hear that at least one mineral had been done away with. Chemically it would be of great interest if it were established that one molecule of water were replaced by one of cupric hydrate; for his part, he should have been inclined to imagine that one of cupric hydrate would have replaced two of water.

Prof. Maskelyne replied that he did not mean to say that there was an actual replacement, but that in this group of minerals one contained three of water, another two water and one cupric hydrate, a third one water and two cupric hydrate, and so on.

Mr. Spiller remarked that he was a pupil of Dr. Percy at the time that he was examining percylite, and some experiments had been made with the object of preparing it artificially, by immersing plates of lead in solutions containing cupric chloride and sulphates; perhaps Prof. Maskelyne could say whether this oxychloride of lead and copper had yet been produced artificially, like atacamite, in the flues at the great copper-mines in Chili.

Mr. Roberts then read a paper "*On the Specific Heat of Occluded Hydrogen*," by W. Chandler Roberts and C. R. A. Wright, D.Sc., in which he stated that, until the experiments were concluded, they desired to abstain as much as possible from giving numerical values, but they might mention that the values for the specific heat varied greatly,—when the palladium was saturated with the gas it was as low as 4 between 0° and 100°; and that when the charge was low the specific heat was as high as 8 or 9,—which might, perhaps, be explained if we regard the first portions of gas absorbed as liquefied and the later portions as solid, the specific heat of a liquid body being greater than when it is in the solid state.

Professor Williamson said the Society would await with interest further particulars on this subject, as until the numerical data were given it could not be discussed. He would like to know, however, how far the experimental errors were likely to affect the numbers given.

Dr. Wright replied that generally two or three experiments were made of each kind, and the difference between the results was extremely small, although he might observe that when the palladium had once been charged and the hydrogen pumped out, and then re-charged, a certain difference was observable in the second experiment, probably attributable to irregularity in the distribution of the

hydrogen through the metal. But the main fact that there was a difference in the specific heat of the occluded hydrogen when the charge of the palladium was high, and when it was low was satisfactorily established.

Mr. J. A. R. NEWLANDS then made a communication "*On a Means of Preventing Explosions in Coal-Mines*," in which, after remarking that diminished atmospheric pressure was frequently the cause of explosion in coal-mines proposed to obviate this by having the upcast and downcast shafts covered by air-tight chambers, the one furnished with an outlet valve, and the other connected with pumping machines to force air into the mine. This might be done by air pumps, or by a ventilating fan, or by the Sprengel pump. In case of an escape of fire-damp a diminished pressure might first be produced in the mine, and the liberated fire-damp subsequently expelled by driving a current of air through the workings.

The CHAIRMAN said it was a matter of great importance and interest, not only to chemists, but to the public at large; the principle seemed to be a sound one, but he could not say whether the mechanical means would answer the purpose.

The last paper was "*On some Possible Reactions that yielded Negative Results*," by Dr. C. R. A. WRIGHT, giving an account of numerous reactions the author had tried but which had not given the desired results. He had made this communication with the view of saving the labour of other chemists who feel disposed to examine these reactions.

Professor WILLIAMSON said that chemists were not sufficiently in the habit of communicating negative results, for if they did it would often save much valuable time and labour. It was quite as much a chemical fact that no reaction took place under given circumstances, as when the reaction yielded some definite result. He supposed it was want of moral courage which prevented chemists recording their failures, and in this Dr. Wright had set us a good example.

The meeting was then adjourned until Thursday, the 21st inst., when Mr. Perkin will read a paper on "*Anthraflavic Acid.*

CHEMICO-AGRICULTURAL SOCIETY OF ULSTER.

THE usual monthly meeting of this Society was held on the 1st inst. in their rooms, Arthur Street, Major Crawford, J.P., presiding. The other members present were—Dr. Ritchie, J.P.; Dr. Hodges; W. R. Jackson, Esq.; and Robert M'Calmont, Esq.

New Members.

Dr. HODGES said that he had very much pleasure in informing them that since the last meeting he had received a letter from Sir Richard Wallace intimating his intention of subscribing £10 annually to the funds of the Society, and he also stated that he expected to occasionally take part in their meetings. He, therefore, proposed that Sir Richard Wallace be appointed a member of the Society.

The motion was unanimously adopted.

J. B. Price, Esq., J.P., was also appointed a member of the Society.

Discovery of the rare Metal Vanadium in the Iron Ores of the County Antrim.

Dr. HODGES stated that, in the alluvial basalt and iron beds of the North of Antrim, the presence of the metal titanium had been noticed by Mr. Riley, and also reported by himself. He wished, however, to make known to the Society that he had, a great many years ago, directed the attention of Mr. Fisher, the lessee of some of the rich ores of Glenravel, to the occurrence of another rare metal, vanadium, in specimens of the ores submitted to him for examination. The existence of vanadium in Irish ores had not previously been detected. The late Professor Thomas Thompson, of Glasgow, discovered it in combination with lead in a mineral brought to him by the well-known veteran mineral explorer, Pat Doran, from an old abandoned lead mine in the County of Wicklow. It has also lately been discovered in the basalt from the Giant's Causeway by Mr. Robert Apjohn.

The Whisky of the County Down.

With respect to his reports on the adulteration of whisky, Dr. Hodges directed attention to some portions of his remarks, which were not so fully given as he wished, and also to some inaccuracies in the published accounts of the last Council meeting. In general their meetings were reported with surprising accuracy, and it was not remarkable that occasionally errors should creep up. Thus, in the last report, he was made to state that the buttermilk which he had submitted to analysis contained tobacco, 9 and 10 per cent of cream, and some samples as much as 21 per cent. This must have surprised some of the members. In reference to the compound used to produce a cheap whisky, and which he stated had been hawked about in County Down, and sold by persons who had no licence, at fairs and other public gatherings, he had received a communication from Mr. James Crawford, J.P., who considered it fair that the present publicans of Crossgar should be exonerated from any suspicion of selling adulterated whisky. The contents of the bottle which, several years ago, had been brought to him by a constable, and which was suspected to be used for the adulteration of whisky, and forwarded for analysis, had been taken in the house of a man who went shortly afterwards to America, so that the circumstance cannot cast any slur on the present publicans of Crossgar, in whose possession no adulterated whisky had been found. With respect to the analyses of articles of food and drink, he (Dr. Hodges) wished to correct the opinion which some people appeared to entertain that it was his duty as borough analyst to search for adulterated articles. This, however, was a mistake; he had nothing to do with the inspection of food, and was merely required to examine articles forwarded to him by the officers appointed by the Town Council. With respect to the extent to which the adulteration of whisky is carried on in some places, it appears that in this country we are not so culpable as our neighbours in Scotland. The *Glasgow Weekly Mail*, of October 5, reports that, of thirty specimens examined, only two were genuine, and several of them were made up of the potent ingredients which were given in the receipt, and referred to at a former meeting. One specimen of the Glasgow whisky, obtained from an itinerant shebeener, is described as having a strongly naphthalitic taste, and containing free and combined sulphuric acid no less than 60 grains per gallon; copper as sulphate (bluestone); also present, shellac, turpentine, methylic and ethylic alcohols of specific gravity 820; about 75 ozs. per gallon. The reporter adds that it contains no whisky, the principal ingredients being Berlin wood spirit, naphtha, and water, the other articles being added to increase the bite.

Cromac Water.

Dr. HODGES said that he was continuing his examinations of the waters in Belfast and the neighbourhood. He had found considerable difference in the composition of the well waters in the Cromac district. The amount of mineral matters, especially of common salt, was much greater in some of the wells than in others. All the samples, however, were remarkably free from nitrogenised impurities. Dr. Hodges stated that a sample lately examined by his son contained per gallon 17·127 grs. of mineral and saline matters, consisting of—Silica, 0·770; oxide of iron, 0·875; carbonate of lime, 1·269; carbonate of magnesia, 3·423; sulphate of lime, 5·270; chloride of potassium, 0·622; chloride of sodium (salt), 4·410. Total, 17·128.

New Patent Ink.

Dr. HODGES intimated that he had taken out a patent for an improved ink for printing bank cheques. He ex-

plained that it was quite possible, by application of a chemical compound, to obliterate any writing on a cheque without defacing the lithographed or engraved portion of it, and numerous frauds had been effected on account of this fact. Dr. Hodges produced a cheque of the Ulster Bank, printed in the ink which he has patented, and showed that if any attempt was made to obliterate the writing on the cheque the lithographed portion would also be defaced, and any attempted fraud thereby immediately detected.

The members expressed a favourable opinion on the utility of the invention.

CORRESPONDENCE.

A MODIFICATION OF MOHR'S BURETTE.

To the Editor of the Chemical News.

Sir,—I wish to add my testimony to that of your other correspondents as to the advantage for small burettes of the modification in question, which consists in regulating the ingress of air at the top of the burette instead of the egress of liquid at the bottom.

I have never found any difficulty with this form of burette, either through changes in the temperature of the laboratory, or in delivering the liquid as required, or owing to leakage.

The screw-clamp which regulates the admission of air may conveniently be wired on to the holder which supports the burette. It is advantageous, also, to fuse a taper spout, 1½ inches long, on to the end of the burette, which is better suited than the end of the burette itself (as Mohr's burettes are commonly made) for dipping into a beaker containing the test-fluid. The taper ending serves also, by its capillarity, to render the liquid less movable by small changes of atmospheric pressure.

I have seen few burettes with stopcocks, where the nature of the test-fluid does not admit of a lubricant, as little liable to drip as a burette thus mounted; and filling by upward motion is much more convenient than filling from the top.—I am, &c.,

A. Vernon Harcourt.

Christ Church College, Oxford.

THE UTILITY OF ODOURS TO PLANTS IN RELATION TO RADIANT HEAT.

To the Editor of the Chemical News.

Sir,—The interesting speculations of your correspondent, Mr. W. H. Olley, in the Chemical News, vol. xxvi., p. 202, as to the part played by the odours of flowers and fruit in tendency to preserve a congenial temperature around them, are probably based in truth. His views are, however, not new. Whether Prof. Tyndall himself saw that those views followed from his researches on the heat-jacketting effects of vapour, I know not; he may possibly have done so, although not referring to the subject in his original memoir; but when thanking Prof. Tyndall for a copy of that paper, some years ago, I myself took occasion ro remark to him (as he may possibly recollect) that his results afforded a probable explanation of one of the uses of the odours of flowers, &c. Indeed the probable connection, as pointed out by myself, and now by Mr. Olley, is so obvious that it can scarcely be missed. Still in this, as in most other cases, we have to ask of Nature the question "how much" before we can convert speculation into truth.

An atmosphere saturated in an odorous vapour is very different from the infinitesimally small and unweighable amount that is sufficient to diffuse the perfume of the flower or fruit, and in such minute proportions the "jacketting" effects, with wind freely blowing around, may be also all but evanescent.

Strong as is the odour of the lemon or orange when the rind is pressed or broken, those who have been in the orange orchards of the South may remember how the odour of the *fruit* rind is scarcely perceptible, unless when these are by any cause rubbed or struck against each other.—I am, &c.,

Robert Mallet.

November 8, 1872.

NEW PROCESSES FOR ANALYSING ETHERS.

To the Editor of the Chemical News.

Sir,—If Dr. Dupré will read Berthelot's "Chimie Organique fondée sur Synthèse," he will find that, before the year 1867, that chemist had analysed a compound ether by weighing the alcohol obtained from it.—I am, &c.,

J. Alfred Wanklyn.

MISCELLANEOUS.

Report on the Condition of the Water Supply to London.—The official reports on the water supply to London are not satisfactory, by reason of the invalidity of the process of analysis adopted by the chemist to whom the Registrar General has confided the drawing up of the reports. As is well known the analyses in question are made by performing an organic analysis on the dry residue left on evaporating the water to dryness, whilst, as is now pretty generally understood, the extreme minuteness of the proportion of organic matter in drinking water, its proneness to change during the evaporation, and the difficulties entailed by the existence of comparatively large quantities of nitrates in drinking water, render the analysis very difficult and inaccurate. So inaccurate is it, that it is altogether illusory. But, although the English Government is employing a defective method for the performance of national work, there is a valid and practicable method known to science—that method is the now well-known ammonia-process, the joint invention of the late Mr. Chapman, Mr. Miles H. Smith, and myself. Almost every authority on the subject of water analysis has declared in favour of the latter process, and with greater or less distinctness against the former. In order to give some idea of this unanimity of the support given to the ammonia-process, it may be mentioned that Mr. Way, who was predecessor to the present Government chemist; the late Dr. W. Allen Miller, who did the water analysis for the Privy Council; Dr. Angus Smith; and Dr. Letheby have declared for it. In this country when Government neglects its duties private enterprise sometimes tries to discharge them. The following, which is the first of a series of monthly analyses of the London waters, is intended as a substitute for the analysis published by the Registrar General.

Thames Companies.	Parts in a Million. (Milligrmmes per Litre.) Free Ammonia.	Albumenoid Ammonia.
Chelsea Co. (Cab Rank, Horse Guards, 5th Oct.)	0·00	0·06
West Middlesex Co. (Drinking Fountain, Marylebone Road, 3rd Oct.)	0·01	0·07
Southwark and Vauxhall Co. ("Red Lion" Tap, Kennington, 2 Oct.)	0·06	0·12
Grand Junction Co. (Cab Rank, in Woodstock Street, 8th Oct.)	0·00	0·07
Lambeth Co. (Main, Newington Butts, 9th Oct.)	0·01	0·10
New River Co. (House Tap, from Cistern, 2nd Oct.)	0·02	0·08
East London Co. (Drinking Fountain, St. John's Church, Bethnal Green, 10th Oct.)	0·01	0·04

J. Alfred Wanklyn.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, November 4, 1872.

In addition to a large number of original papers and memoirs relating to astronomy, meteorology, mathematics, natural history, geology, and comparative anatomy, this number contains the following original papers and memoirs relating to chemistry:—

Production of Alcohol by Fruit.—Professor Pasteur.—The author states that, as far back as the year 1869, Professors Lechartier and Bellamy made similar experiments to those referred to by him at the meeting of the Academy on October 7, respecting the formation of alcohol in fruit, and on the gases given off by fruit during its period of ripening; the results obtained agree in the main points with those obtained by Professor Pasteur, who, however, calls attention to the fact that his method differs essentially from that employed by the other authors, and that this is the cause of some of the discrepancies of the results.

New Discussion on Fermentation.—Professor Pasteur.—The author says that he placed in narrow tubes some juice obtained by simply squeezing grapes; this small quantity of juice could not possibly, at least according to Professor Fremy's opinion, have entered into fermentation under the conditions named, yet within twenty-four hours a vigorous fermentation had set in, and yeast was produced as usual, thereby proving that the objections made by Professor Fremy are not well founded. This communication gave rise to a reply by Professor Fremy, and Professor Pasteur afterwards requested the appointment of a committee of inquiry. Professor Dumas observed that for the purpose of verifying experiments a committee could be appointed, but not for appreciating scientific doctrines, and, as no doubt was thrown on the rigorous accuracy of Professor Pasteur's experiments, a committee was not required. Professor Fremy replied again, but the President, fearing that the discussion might become interminable, postponed the subject till next session.

Researches on Crystalline Dissociation; New Method for Studying the Coercive Action of Water upon Salts at Divers Temperatures.—P. A. Favre and C. A. Valson.—The continuation of a monograph on this subject.

New Process for the Mediate Analysis of Rocks, and Application of that Process to the Lava Obtained from the Latest Eruption of Santorin.—F. Fouqué.—This essay treats on the mechanical and chemical means employed for separating the different crystalline and amorphous constituents from rocks and minerals. The author recommends the use of concentrated hydrofluoric acid on the one hand, and electro-magnetic power on the other; he describes the application of his process to the lava referred to above.

Action of a Couple of Copper-Cadmium Plates upon a Solution of Sulphate of Cadmium.—F. Raoult.—Into a slightly acidulated solution of sulphate of cadmium, freed from air, are placed two small strips of sheet-copper and of sheet-cadmium, both being entirely immersed in the fluid and not touching each other, care being taken to prevent access of air by pouring some oil on to the surface of the liquid. As long as the two metals are not in contact, nothing particular is observed; but as soon as a suitable motion is given to the vessel in which the fluids and metals are placed, and contact is thereby established between the two metals, cadmium is reduced and deposited upon the copper.

The Anti-Fermentation Property of Silicate of Soda.—M. Picot.—After first briefly referring to the researches of Rabuteau and Papillon on this subject, the author describes at length the results of a series of experiments, from which it appears that, even in small quantity, silicate of soda exerts a powerful effect—of either entirely arresting, or greatly reducing in activity, the alcoholic and the lactic, as well as the putrid, fermentation.

Le Moniteur Scientifique Quesneville, No. 371, November, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral sciences:—

On Pulmonary Respiration and on Animal Heat.—Ch. Blondeau.—The end of an exhaustive monograph on this subject.

Mustard Studied Therapeutically, and its Applications to Practical Medicine.—Dr. H. Astier.—By pressure mustard-seed yields a fixed oil analogous to colza oil, and, in addition, the seed contains albumen, sugar, gum, colouring matter, a green-coloured substance, sinapisine in small quantity, a free acid, some salts (more especially those of potassa), and, lastly, myrosine and myronate of potassa, by the mutual reaction of which, under the influence of water, the essential oil of mustard, or sulphocyanide of allyl, is formed. Myrosine is soluble in water, is coagulable by heat, alcohol, and acids, and is best extracted from white mustard-seed by exhausting it first with cold water, and evaporating this fluid at a temperature not exceeding 40° to the consistency of a syrup, from which the myrosine is precipitated by alcohol. The myronate of potassa is extracted from black mustard-seed (the white only contains a trace), which is first deprived of its fixed oil by strong pressure or by the aid of sulphide of carbon. The residue is next treated with alcohol at 85 per cent heated to about 60°, for the purpose of eliminating such substances as would interfere with the crystallisation of the myronate of potassa. The residue is next treated with tepid water, which dissolves the myronate of potassa; the liquor thus obtained is evaporated to the consistency of a syrup, and then treated with weak alcohol for the purpose of precipitating mucilaginous matters, after which the fluid is concentrated by evaporation, and left to crystallise. The myronate of potassa is, lastly, washed with weak alcohol, yielding perfectly colourless crystals. If it is desired to separate the myronic acid (for it is that substance which, with myrosine, yields, by contact with water, the essential oil of mustard, or sulphocyanide of allyl—

$$C_8H_5NS_2 = C_6H_5S,Cy),$$

the myronate of potassa is dissolved in water, and mixed with a solution of tartaric acid, then filtered, concentrated by evaporation, and next treated with alcohol; myronic acid can only be obtained as a syrup-like fluid, of an acid taste, but without smell. The pure essential oil of mustard, or sulphocyanide of allyl, is a colourless oily liquid, boiling at 143°, slightly soluble in water, but in every proportion in alcohol and ether; with ammonia it yields a crystalline compound, thiosinamine, ($C_8H_8N_2S_2$). White mustard-seed contains sinapine or sinapisine, ($C_{22}H_{24}O_{10}$), combined with hydrosulphocyanic acid. This essay also contains valuable information on the best modes of applying mustard therapeutically.

Intégrometer.—A. Jouglet.—The description, elucidated by woodcuts, of an ingeniously-contrived instrument, invented by Deprez and Collignon, for the purpose of facilitating, and even superseding, geometrical calculations.

Non-Freezing Public Fountain.—MM. Broquin and Lainé.—The detailed description, elucidated by engravings, of a well-arranged mechanism to prevent public fountains, not uninterruptedly flowing, from freezing and consequent bursting of pipes.

Compression of Air and of Gases.—M. Colladon.—The account of an apparatus by the aid of which air or gases may be strongly compressed, while, at the same time, the necessary arrangement is made to cool the gases without the necessity of introducing water into the force-pumps. It appears that, notwithstanding the somewhat complicate construction of the machinery, it is effective and not liable to become readily disabled by use.

Annalen der Physik und Chemie, von Dr. J. C, Poggendorff, No. 10 1872.

This number contains the following original essays and papers relating to chemistry and collateral sciences:—

Behaviour during Expansion of Superheated Vapours.—Dr. H. Herwig.—An algebraico-physical essay.

Diosmotic (Diosmotische) Researches.—J. Baranetzky.—This monograph, illustrated by engravings, treats of the phenomena of endosmose, exosmose, diffusion, and osmose.

Mineralogical Communications.—G. vom Rath.—The last portion of a paper on this subject, treating of humite, of leucite expelled from Vesuvius, of a mineral like cyanite met with in the basalt on the banks of the Rhine, and of two soda-lime felspars from the Ural.

Contributions to Micro-Mineralogy.—Dr. von Lasaulx.—The conclusion of the author's monograph on this subject, illustrated by engravings.

Polytechnisches Journal von Dr. E. M. Dingler, first number for October, 1872.

This number contains the following original papers and essays relating to chemistry and collateral subjects:—

Manufacture of Dynamite.—F. Capitaine.—This essay details the preparation of dynamite as carried on industrially with a yield of 5 tons a day. The preparation of the nitro-glycerine is conducted by the safest operations possible.

Estimation of the Quantity of Pure Sugar Contained in Various Kinds of Raw Beet-Root Sugar.—Dr. E. Scheibler.—This essay, illustrated by engravings of the apparatus, contains the description of a method of sugar estimation which is a modification of Payen's plan of treating the raw sugar with a mixture of strong alcohol and concentrated acetic acid.

Industrial Preparation of Blood- and Egg-Albumen.—E. Campe.—This essay treats exhaustively of the preparation of the large quantities of dried albumen required by calico-printers.

Dyeing of Furs.—F. F. Keferstein.

Portable Odourless Earth-Closet.—E. Cohn.—Illustrated by a woodcut; the arrangement is very similar to one of the closets patented by Mr. Bostel, of Brighton.

Constituents of Tobacco Smoke.—Eulenburg and Vohl.—Tobacco smoke does not contain, as is often supposed, nicotine; but the authors found ammonia, pyridine, picoline, lutidine, collidine, formic, acetic, propionic, butyric, valerianic, and carbolic acids, and creosote (Reichenbach's).

Journal für Praktische Chemie, No. 13, 1872.

This number contains the following original papers and memoirs:—

Some New Organic Compounds, and on New Means of Preparing the same.—Dr. F. Pfankuch.—This essay, divided into three main sections, treats on cyanoform and methin-tricarbonic acid. The preparation of the mercuro-iodide of cyanoform is first described at great length; this compound is soluble in ether and in alcohol, and also combines with iodide of ammonium, the mercury being eliminated; the formula of the mercury combination is $C_2H_2N_6Hg_3I_6$. Cyanoform has not been isolated, but, by treating one of its combinations with caustic soda, methin-tricarbonic acid is formed; this is a strong acid, readily combining with bases, and yielding with them crystallisable salts; the formula of this acid is $C_3H_4O_6$, and it is in free state a solid crystalline compound, soluble in ether. The second part of this paper treats exhaustively on a new method of preparing, by a complicated process, hydrocarbons; and the third section treats on some new reactions of sulphur, chiefly based upon the strong affinity for oxygen which sulphur exhibits at a high temperature, also when in contact with organic bodies.

Cyancarbonic Acid Ether.—A. Weddige.—This substance is prepared by the reaction of phosphoric anhydride upon oxamethan. The ether is a clear, limpid, mobile fluid, boiling at between 115° and 116°; it is insoluble in water, but, when left for a long time in contact with it, the ether is decomposed, with the formation of hydrocyanic acid, carbonic acid, and alcohol; the formula of this ether is—

$$\begin{matrix} CN \\ | \\ COOC_2H_5 \end{matrix}$$

Method for the Quantitative Estimation of Asparagine.—Dr. R. Sachsse.—An essay of great scientific value, but not suited for abstraction.

Action of the Hydrogen Occluded in Palladium upon some Organic Compounds.—Dr. M. Saytzeff.—This monograph, illustrated by woodcuts, is divided into the following sections:—Introduction, recording a *resumé* of the labours of the late Professor Graham, of Drs. Kolbe, Böttcher, and others; action of the hydrogen absorbed by palladium upon benzoyl chloride, upon nitro-benzol, nitro-phenol, and nitro-carbol.

Some Derivatives of Mucic Acid.—M. Köttnitz.—This essay, of which only a portion is here published, treats on mucate of aniline, $C_6H_{10}O_8(C_6H_5H_2N)_2$, a crystalline compound, soluble in water, but insoluble in alcohol, decomposed by alkalics, aniline being set free, and mucate of the base formed. The author further treats at length on the behaviour of mucate of aniline when boiled for a long time, whereby an impure compound only is obtained, and next on the behaviour of mucate of aniline when heated in an air-bath, whereby anilide of mucic acid is formed, the formula of that compound being—

$$\left.\begin{matrix} C_6H_5H \\ C_6H_3O_6 \\ C_6H_5H \end{matrix}\right\} N_2.$$

Neues Jahrbuch für Pharmacie und Verwandte Fächer, von Dr. F. Vorwerk, September, 1872.

In addition to papers particularly relating to pharmacy, this number contains the following original papers relating to chemistry:—

Contribution to our Knowledge of Gum Arabic.—Dr. Graeger. After a reference to Fremy's researches, the author treats on metagummic acid—premising that the gum arabic of commerce is essentially a salt, and chiefly a lime salt of this acid—which is an amorphous, rather hygroscopic, compound, colourless and tasteless; in moist state it exhibits a decidedly acid reaction, and is insoluble in pure water, but readily soluble in very dilute alkaline fluids; formula, $C_7H_8O_7$. By treatment first with lime-water, and next with oxalic acid, gummic acid is formed, which is an amorphous compound, soluble in water, and strongly acid.

On Hydrocyanates of Alkaloids.—F. A. Flückiger.—From the researches here recorded it appears that the hydrocyanates of berberine, morphine, cinchonine, and strychnine, do not exist, since the compounds taken to be combinations of these alkaloids and hydrocyanic acid are simply the free alkaloids.

Chemical Investigation of German and other Wines.—G. Gläsner.—The author exhibits the quantity by weight per cent of alcohol, of grape sugar, of free acid, of extract, and of mineral matter, contained in a number of various samples of wine.

Detection of Water and of Alcohol in Ether.—R. Bœttger.—To 10 c.c. of the ether to be tested add an equal bulk of pure sulphide of carbon, and shake the mixture; if the ether is anhydrous, a perfectly homogeneous fluid will be obtained, but, when the least trace of water is present in the ether, the mixed fluids exhibit a milky appearance; when the ether contains alcohol, a piece of dry caustic potassa, left in contact with the ether for twenty-four hours, will become coated with a yellowish-coloured matter.

Les Mondes, October 31, 1872.

Curious Experiment.—Rev. Father Lafond, S.J.—Take a chameleon-top, and place on the centre one of the discs sold with that toy; then, instead of obtaining the optical illusions produced by touching the surface of the spinning top with a pointed instrument (checked motion of Wheatstone), place on the table a large Geissler tube, and the result of this illumination will be the exhibition of the most varied and charming colours and designs, without the necessity of touching the disc placed on the spinning top. This experiment also proves that the light given off by the Geissler tubes is *intermittent*.

Taupe Marine.—G. Toselli.—The author has had made an improved machine of this description; it is a kind of diving-bell, and is destined for coral-fishing purposes on the Sardinian coasts. This machine, weighing 4 tons, and constructed at Paris, will be first tried in the Mediterranean off Marseilles; by its aid depths to which divers would never be able to descend can be explored, and the men can remain under water for a whole day if required with safety and without any inconvenience.

Manure for Horticultural Use.—Dr. Jeannel.—This is made as follows:—Nitrate of ammonia, 400 parts; biphosphate of ammonia, 200; nitrate of potassa, 250; chloride of ammonium, 50; sulphate of lime, 60; sulphate of iron, 40. These ingredients are pulverised, well mixed, and kept in well-closed dry bottles. 4 grms. of this mixture are dissolved in 1 litre of water, and to each plant (in pots or in open ground) is given weekly a dose of from 25 to 50 or, even in some cases, 100 grms. It is best to pour the liquid in the saucers in which the pots are placed.

Method of Measuring the Velocity of Light with more Precision.—L'Abbé Laborde.—An optical essay, illustrated by a woodcut.

November 7, 1872.

Inauguration of the New Observatory at Florence.—C. Flammarion.—On the hill of Arcetri, the scene of the labours of Galileo Gallilei during the later years of his life, has been constructed a well-arranged observatory, under the care of Donati. This scientific establishment has just been inaugurated in the presence of a number of distinguished men, worthy representatives of a nation which follows the steps of those illustrious *savants* whose labours have rendered Italy, and especially Florence, renowned in the annals of science.

Atmospheric Postal Communication between England and France.—E. Martin.—In a letter to the Editor, the author suggests the plan of laying down between Cape Gris-Nez and Shakespeare Cliff, Dover (a distance of 29 kilometres), a series of iron tubes similar to those already in use in London and Paris for the conveyance of mails by atmospheric pressure.

Taupe Marine.—J. B. Toselli.—The detailed illustrated description of this ingeniously-contrived machine, which will be found to supersede anything of the kind hitherto invented for executing with perfect ease and safety work under water.

Petites Annales de Chimie.—E. J. Maumené.—The eighth portion of this monograph.

La Revue Scientifique de la France et de l'Etranger, November 2, 1872.

This number contains no original papers relating to chemistry, but we quote the titles of the following memoirs:—

Biography of the Late Professor Babinet.—E. Alglave.

Scientific Instruments and Implements Required by Military Officers in Field Duty.—A. Lausedat.—An illustrated description of physical instruments which may also be of service for general scientific purposes.

November 9, 1872.

This number contains no original papers relating to chemistry, but we call attention to the following memoir:—

Phenomena of Life Common to Plants as well as Animals.—Dr. C. Bernard.—This essay, the concluding portion of the author's lectures on general physiology, is divided into the following sections:—Identity of animal glucogen and vegetable starch in a physiological point of view; origin and formation of glucose in animals and plants; conditions which influence the glucogenesis.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2711. W. D. Ruck, Greenwich, Kent, "Improvements in the manufacture of gas."—Petition recorded September 12, 1872.

2988. J. Young, Kelly, Renfrewshire, N.B., "Improvements in treating liquors containing ammoniacal compounds in order to obtain products therefrom."—Petition recorded October 10, 1872.

3056. A. V. Newton, Chancery Lane, Middlesex, "An improvement in the manufacture of iron and steel wire."—A communication from D. H. Rump, Altena, Westphalia, Prussia.—Petition recorded October 16, 1872.

3101. W. R. Lake, Southampton Buildings, London, "Improved processes and apparatus for manufacturing compounds of pyroxyline or gun-cotton."—A communication from J. W. Hyatt and J. S. Hyatt, Albany, New York, U.S.A.

3103. R. F. Fairlie, Victoria Street, Westminster, "Improvements in apparatus for the extraction of nitrate of soda from crude nitrate earth-stone, usually called calèche."—Petitions recorded October 21 1872.

3142. A. V. Newton, Chancery Lane, Middlesex, "Improvements in furnaces for burning sulphurous ores."—A communication from K. Walter, Augsburg, Bavaria.—Petition recorded October 23, 1872.

3163. A. Allison, Bayswater, Middlesex, "Improved means of preserving and curing raw meat, in packing the same, and in apparatus employed therewith."

3173. E. Rowe, Brentwood, Essex, "Improvements in treating earths or materials containing metallic oxides, and in obtaining products therefrom, and in the use of such products."—Petitions recorded October 25, 1872.

3180. A. Malam, Dumfries, N.B., "Improvements in the manufacture of illuminating gas, and in apparatus therefor."—Petition recorded October 26, 1872.

3192. E. P. H. Vaughan, F.C.S., Chancery Lane, Middlesex, "Improvements in the mode of, and apparatus for, generating gas for lighting and heating purposes."—A communication from E. A. Dubois, Paris.—October 28, 1872.

3215. J. L. F. Target, Portsdown Road, Middlesex, "Improved means of effecting the separation of solid excrement and urine in closets."—Petition recorded October 30, 1872.

NOTICES TO PROCEED.

1845. W. Bull, Chancery Lane, Middlesex, "Improvements in making salt from brine."—Petition recorded June 19, 1872.

1948. F. J. Cheesbrough, Liverpool, "Improvements in the process of manufacturing oil and oil-cake from seeds, and in the machinery to be used therein."—A communication from W. B. Fisher, Newark, N.J., U.S.A.—Petition recorded June 27, 1872.

1584. W. E. Gedge, Wellington Street, Strand, Middlesex, "A new or improved process of preparing phosphorus."—A communication from A. Pelhuche, Faubourg St. Martin, Paris.—Petition recorded July 1, 1872.

2930. J. G. N. Alleyne, Alfreton, Derbyshire, "Improvements in apparatus for the manufacturing and refining of sugar and rum or other spirit."—Petition recorded October 4, 1872.

2975. H. Clayton, H. Clayton, jun., and F. Howlett, Woodfield Road, Harrow Road, Middlesex, "Improvements in treating peat, and in apparatus employed therein."—Petition recorded October 9, 1872.

3003. J. Steedman, Glasgow, N.B., "Improvements in obtaining acetic acid."—Petition recorded October 11, 1872.

PATENTS SEALED.

1432. J. Sutherland, Glasgow, N.B., "Improvements in furnaces for puddling and re-heating iron."

1442. W. Gossage, Widnes, Lancashire, "Improvements in the manufacture of certain alkaline carbonates for the purpose of obtaining carbonic acid gas therefrom."—Dated May 11, 1872.

1477. A. Fryer, Manchester, "Improvements in the treatment of cane sugar, and in machinery or apparatus to be employed in connection therewith."—Dated May 15, 1872.

1554. G. Haycraft, Faversham, Kent, "Improvements in the manufacture of pebble gunpowder, and in machinery for the same."—Dated May 22, 1872.

1745. M. Rae, Uphall, Linlithgow, N.B., "Improvements in the manufacture or preparation of fuel."—Dated June 10, 1872.

2332. J. Deere, Briton Ferry, Glamorganshire, "Improvements in the manufacture of artificial fuel."—Dated August 5, 1872.

2341. C. Morfit, Baltimore, Ma., U.S.A., "Improvements in the manufacture of pure phosphates of lime."—Dated August 6, 1872.

2344. C. Morfit, Baltimore, Ma., U.S.A., "Improvements in the chemical treatment of mineral and other crude phosphates of lime."—Dated August 7, 1872.

2357. C. Morfit, Baltimore, Ma., U.S.A., "An artificial substitute for 'Redonda guano,' 'Altavela' guano, and other natural phosphates of alumina to be used in the defecation of sewage, in the manufacture of sugar from cane and beet-root juices, and in the preparation of certain chemical products, such as pure alumina and the alkaline and earthy phosphates and aluminates."—Dated August 8, 1872.

2644. J. Harvey, Vere, Jamaica, "Improvements in the manufacture of sugar, and in apparatus therefor."—Dated September 5, 1872.

2783. J. H. Valleton and J. E. Planque, Great Tower Street, London, "Improvements in the manufacture of bread, biscuits, and pastry."—Dated September 19, 1872.

FOREIGN PATENTS.

FRANCE.

95663. Bures, "A substitute for chicory and other like coffees."

95675. Jeyes, "Improved fuel."

95686. Pinkus, "Improvements in machines, apparatus, and processes for the manufacture of iron and fuel, and for metallurgical operations."

95716. Lamvers, "Using and making coloured grain for destroying rats, mice, moles, &c."

95728. Ames, "A process for tempering or hardening the surface of steel."

95730. Campbell, "An improved process for the treatment of sewage and for obtaining manure therefrom."

95740. Janot and Lefèvre, "Preserved soup for soldiers."

95742. Lafond-Caillot, "Manufacturing lighting and heating gas, and applying the same."

95747. Mignon and Rouart, "Methods of and apparatus for treating wine by a cold process."

95756. Sillar and Rawson, "Improvements in the treatment of animal matter for its disinfection, decomposition, and conversion into manure."

95757. Sinclair, "Improvements in the treatment of spent lye of wood pulp."

NOTES AND QUERIES.

Bleaching Shellac.—Can you inform me of a practical process for bleaching shellac to make colourless French polish, or for dissolving the bleached lac of commerce in alcohol for the same end? All the white lac I have ever been able to try has appeared absolutely insoluble, and I have been informed that it is necessary to dissolve the lac immediately after bleaching, as it afterwards becomes insoluble.—Lac Insect.

[Dissolve the lac first in a boiling lye of caustic potassa or soda, and next pass chlorine through the solution until all the lac is precipitated; this is collected, washed, and pulled in hot water, twisted into sticks, and finally thrown into cold water. The bleached shellac, if properly prepared, dissolves perfectly in methylated spirits, but it requires more of that fluid for solution than the unbleached lac, and the solution requires the aid of heat].

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THE CHEMICAL NEWS.

VOL. XXVI. No. 678.

ON THE LOSS THROUGH VOLATILISATION IN THE CORNISH COPPER ASSAY.

By CORNELIUS A. MAHONY.

ALL the copper ores sold in the English market have their produce determined by the dry Cornish assay, a method which, while it gives concordant results (the limit of error being ¼ per cent), always fails to indicate the true amount of metal contained in the sample, owing almost entirely to the fact that copper is sensibly volatile in the presence of sodium chloride, a substance largely used in the assay.

There are three distinct stages in the assay, viz.—

1. Fusion for regulus.
2. Calcination of regulus.
3. Refining of regulus.

The first operation has for its object the production of a regulus, or matt, containing all the copper, together with iron, sulphur, and traces of other metals. To effect this the ore is mixed with a flux, composed of lime, fluor-spar, borax, and salt, together with a definite quantity of nitre. As the salt is without action on the metallic sulphides formed, its use here is not open to objection.

In the second operation the sulphides are carefully roasted, to expel the sulphur (after having been first ground very fine), and any loss that may seem must necessarily be in manipulation.

The third stage, and the one in which the error of copper almost entirely takes place, is the fusion for coarse copper and refining. The oxides produced in the last operation are reduced at a high temperature, in the presence of argol, nitre, borax, and salt (about 100 grains of the latter being used), and the crude button of metal obtained is again subject to fusion with "refining flux," composed of equal parts tartar and nitre one ladle, and salt one ladle. One ladle about 5 dwts. This fusion is repeated three or four times if required, until the button presents the appearance of "fine copper." The slags from all the fusions are then reduced with a small ladle of argol, when a "prill," or little globule of copper more or less impregnated with iron, is obtained, which is weighed, together with the large button, and the percentage expressed to eighths.

The usual time the button is exposed to the furnace heat, in refining, is from 3 to 5 minutes; and in order to have data for the amount of volatilisation likely to occur during such exposure, the following experiment was resorted to, viz.:—

A button of pure copper was subject to four several fusions with sodium chloride, and carefully weighed after each, the heat of the assay furnace being that necessary in the refining operation. The button operated on weighed 49·51 grs., and 240 grs. of salt were used at each fusion. The loss of weight was as follows:—0·33, 0·34, 0·21, and 0·42 grs. respectively, giving an average of 0·32 grs. of loss for 5 minutes' fusion. The slag contained a mere trace of copper.

Another button, weighing 48·32 grs., lost 0·31, 0·33, and 0·32 grs, in three several fusions, with 480 grs. sodium chloride.

To ascertain the loss actually sustained through volatilisation, in the dry assay, three samples were assayed, the button of copper obtained weighed, and the small percentage left in the slag carefully estimated by wet process, and its weight added to that of the large button. The difference between the percentage thus formed and the total percentage of copper in the sample determined in the wet way, by titrating with standard potassic cyanide, was put down as loss through volatilisation.

No.	Per-centage from Button.	Per-centage in Slag.	Total per-centage.	Per-centage by Wet Assay.	Loss = difference of − D.	Description of Sample.
1.	10·12	0·07	10·19	11·25	1·06	Copper pyrites.
2.	8·88	0·12	9·00	10·20	1·20	,, ,,
3.	13·88	0·27	14·15	15·00	0·85	,, ,,

It would appear that, by making as few fusions as possible in the refining process, the loss might be diminished, but, on the other hand, it would then become necessary to procure a very fine regulus, and we would run the danger of allowing copper to pass into the slag of our first operation.

I would suggest to metallurgical chemists the desirability of devising a substitute for sodium chloride, and thus giving to this assay something approaching to analytical accuracy. Experiments made with glass of borax have resulted in failure; neither are the alkaline carbonates suitable; yet I believe that it may be feasible to devise a flux in the presence of which copper will not be so volatile, and thus remove the *bête noir* of the Cornish copper assay.

THE CHEMICAL PROCESS OF RESPIRATION CONSIDERED AS A PHENOMENON OF DISSOCIATION.

By F. C. DONDERS, M.D., &c.,
Professor in the Medical Faculty of Utrecht University.

FOR the ancient chemical theories of respiration a mechanical one, first established by Magnus, has been substituted. The idea upon which this theory is based is a physical exchange of the gases dissolved in the blood, and those of the air which fills the lungs. A kind of diffusion therefore takes place; but this theory was not found to hold good without the aid of what have been termed instable, lax, chemical combinations, and facts were successively discovered which indicated a real chemical action. So long as the gases could be either chased away into a vacuum or expelled by the aid of other gases one had to deal (unless it were a simple case of solution) with a lax (*lache*) chemical combination; but when the gases were so fixed that these means no longer sufficed for their expulsion, there could be no more question of a true chemical combination, *in optima forma*, being certainly at work. It is in this manner, as proved by Pflüger, that the blood drawn from a vein fixes in a few minutes a certain quantity of oxygen, and an analogous chemical action takes place in the interior of the capillary vessels of the great circulation, as well as in their immediate neighbourhood. It is by another chemical action that the lungs actively promote the expulsion of CO_2 (Ludwig). But I do not here wish to allude further to the above-mentioned phenomena, which, moreover, are already beyond the proper notion of the chemical process of respiration.

I intend to confine myself to the reversible actions,—the expulsion for an unlimited number of times of O by CO_2 and of CO_2 by O, of which Magnus's experiments have given us a clear idea,—actions which, leaving solution out of the question, have been referred to "lax" chemical combinations: in other words, I shall treat on the condition of the exchange of gases, in the form in which it takes place with given gases, without taking into consideration what precedes or follows; for it is within these limits that, according to my opinion, the chemical process of respiration has to be interpreted as a phenomenon of dissociation. These lax combinations are in a state of dissociation, *partly* entire, *partly* destroyed.

Dissociation is either the resolution (*résolution*) of the molecule of a body into two or more molecules of a new

and less complex combination, either similar or dissimilar to each other—

$$(N_2O_4 = NO_2 + NO_2, \text{ and } CaCO_3 = CaO + CO_2),$$

or the reaction of one molecule upon another, thus giving rise to the formation of new molecules by double decomposition ($H_2O + H_2O = 2(H_2) + O_2$). The characteristic of dissociation is, that the phenomena are brought about *under the influence of a certain temperature*, without the intervention of any other body. This is the definition of dissociation in the widest sense of the word, but in a more restricted sense it comprehends the phenomena before mentioned only when the action is reversible in such a manner that the molecules, into which the body is split up by the heat, re-unite to form the primitive combination as soon as the primitive conditions of temperature and tension which previously existed are re-established. Such reversible actions are apparent in the two instances I have cited.

As instances of non-reversible actions we may quote the dissociation of ammonia into nitrogen and hydrogen ($NH_3 + NH_3 = N_2 + 3H_2$), and also the decomposition, by heat, of sugar, albuminoid matter, &c. In the reversible actions we have to deal both with the mobile equilibrium of the molecules, on which much light has been thrown by Drs. Buys-Ballot and Pfaundler, and also with the *chemismus* (*chimisme*) of the respiration.

A compound is in the condition of dissociation when, under the influence of a constant temperature, it is partly decomposed, while another portion of the same compound remains unaltered. This partial decomposition is most readily observed when the body undergoing dissociation is itself fixed, while one or more of its products of decomposition has assumed the gaseous condition. Carbonate of lime is a good example of this, for, as proved by Debray, this substance heated in vacuum up to 350°; a scarcely perceptible decomposition took place at 440° (temperature of dissociation); at 860° the decomposition continued, so that the pressure of the carbonic acid set free was equal to 85 m.m.; while at 1060° this pressure attained 520 m.m. The condition of equilibrium for a given temperature is attained when the density of the CO_2 gas is such that the number of outgoing molecules is equal to the number of ingoing molecules (mobile equilibrium of the molecules). When the outgoing molecules are gradually carried off, by an atmosphere free from carbonic acid, so that no more molecules can enter, the decomposition becomes complete, provided always that the temperature of dissociation be attained, and that decomposition proceeds more rapidly the higher the temperature. A solution of bicarbonate of potassa charged with an excess of crystals of that salt, and placed in a vacuum, also loses carbonic acid in the same manner, until that gas in free state exerts a determined pressure, which increases with the temperature. Even at the ordinary temperature this salt and also the bicarbonate of soda are completely converted into neutral carbonates, when the products CO_2 and H_2O are gradually carried off while being evolved,—an operation which takes place even at 10°, while of course at a higher temperature the operation of conversion into neutral carbonate goes on more rapidly. In the reversible process the dissociation is accompanied by an absorption of heat, while, by the re-combination, an evolution of heat takes place.

The definition just given of the phenomenon of dissociation is sufficient to prove that it plays an essential part in the exchange of gaseous matter which takes place in the blood: it is rather curious that this has not been already recognised and made generally known,—the more so since *all* the facts known concerning absorption, the displacement (*déplacement*), and extraction of the gases from blood, concur with this view. We here come in contact with substances which are in the condition of dissociation at the ordinary temperature: there, where the quantities agree with Dalton's law, we admit ordinary solution, such as undoubtedly takes place with nitrogen. In several salts, and probably also in some of the albumenoid matters present in the plasma of the blood, as well as in the blood corpuscles, we find these bodies in a condition of dissociation, so that they yield CO_2, in the presence of the tension of CO_2, such as it exists in the lungs, which absorb it according to the degree of tension it has in the tissues, this action being dependent upon the limits of the temperature by which it is, to a certain extent, regulated.

As regards oxygen, the oxyhæmoglobine is the body in a state of dissociation, since it absorbs O under the degree of pressure of that gas in the lungs, and gives it off again under the conditions of pressure of that gas which obtains in the tissues, either action being undoubtedly aided by the intermediate of the blood plasma, which, as regards O, behaves rather as a simple solvent.

According to this view it is necessary that the determinations which are in general required for bodies in the state of dissociation be made for blood, and for some of its constituents; thus the determination of the temperature at which the dissociation begins, that of the degree of dissociation in reference to the tension and to the temperature, and also the degree of rapidity with which the dissociation proceeds.

It is clear that many important questions concerning the molecular renovation (*rénovation moléculaire*) in warm- and cold-blooded animals, in normal and abnormal conditions, are bound up with these determinations. In some of the researches made by me on this subject, I have also noticed the combination of the oxide of carbon with the hæmoglobine of the blood-corpuscles; but I have up to the present time chiefly studied the influence of the temperature on the phenomena of dissociation, and the following results have been obtained:—

I. Defibrinated blood having been shaken to saturation with atmospheric air previously freed from CO_2, oxygen was expelled from the blood.

(*a*). By H at 0°, temperature of dissociation being barely attained; at 1°, dissociation unquestionable, although very weak; at 37°, the current of H drives off more oxygen in 10 seconds of time than at 1° in 1000 seconds.

(*b*). By CO_2, it is found that at 37° O is expelled more rapidly than at 0°, although at 0° more O is probably absorbed. Even at 0° the samples of blood operated upon are rendered of a dark colour in a few seconds of time; and in this respect CO_2 acts far more rapidly than H. It should be observed that the samples submitted to the action of CO_2 do not become darker coloured till after 1 or 2 days, but even then the colour is brighter than that exhibited by the samples only treated with air deprived of CO_2 without further treatment to a current of CO_2. At the end of two and a half days all the samples exhibit the same colour; hence it follows that the decrease of O and absorption of CO_2 prevents the ulterior transformation of the blood. It appears that CO_2 generally has a depressing effect upon the chemical actions of which it is itself one of the products. From this point of view it is explainable that the presence of CO_2 and the decrease of the quantity of O are both in the same manner, viz., by slackening the speed of the molecular exchange, the indirect active stimulant of the respiratory motion. When a current of CO_2 is passed through blood at a higher temperature, the result is that after a certain time the hæmoglobine becomes slightly decomposed, and consequently the experiments are not to be relied upon.

II. Defibrinated blood, first treated with CO_2 in excess and next submitted to the action of a current of atmospheric air completely free from CO_2, becomes of a bright red colour far more rapidly at 0° than at 37°. At 0° the bright colour was more developed in half a second than at 37° after the lapse of one minute. After the passage of the air had been continued through both samples for six minutes of time, they were equally and identically bright in colour. At 0°, the blood through which air was passed, formed, *ceteris paribus* (*toutes conditions égales d'ailleurs*), bubbles exhibiting a larger surface. This circumstance in

Experiment I. exerted an unfavourable influence on the evolution of O; in Experiment II. a favourable influence on its absorption. Consequently the result of I. is, *a fortiori*, true, and more fully proved than that of II.; in respect of which, new experiments conducted in a different manner will be necessary.

III. Defibrinated blood, first saturated with oxide of carbon submitted to a current of O, of H, or of CO_2, loses its oxide of carbon already at 0°, so that the hæmoglobine is more and more freed of its CO. The assertion of Hermann that O is driven out from its combinations with hæmoglobine by CO, but that a reciprocal action does not take place is not true; even H expels CO, and even at 0° the CO hæmoglobine is in a state of dissociation. Temperature plays a great part in the expulsion by H; while as regards expulsion by O, the influence of the temperature is very slight. Under the influence of a current of O CO is not expelled in the condition of CO_2. When every trace of CO_2 has been expelled from blood by means of CO, and the blood next submitted to the action of a current of air previously freed completely from carbonic acid, it does not yield even at 37° any appreciable quantity of CO_2 while the experiment is continued for a whole hour; during which time a great part of the CO-hemoglobine is converted into oxy-hæmoglobine. In my first experiments, sufficient care had not been taken about the complete expulsion of the gas CO quite free from CO_2, and I had found traces of CO_2 in the air after it had passed through the blood. CO_2 drives out CO more rapidly at 37° and at 40° than at 0°; but this action also causes the decomposition of the hæmoglobine, and renders the blood brown coloured. It remains to be proved whether in the—according to Hermann—far more stable combination of hæmoglobine with oxide of nitrogen the temperature of dissociation is also attained at 0°.

IV. Paraglobuline, precipitated by CO_2 in dilute serum, is red; it is dissolved as well by the influence of H (first discovered by Dr. Heynsius) as by that of O, but in the latter case the solution is more complete, while it is far more rapidly effected at 37° than at 0°. It is probable that paraglobuline is a combination—soluble in the salts (serum)—of globuline and carbonic acid, a combination which is in a condition of dissociation at the ordinary temperature. The experimental demonstration of the hypothesis that paraglobuline is CO_2-globuline is confronted with the difficulty of obtaining paraglobuline in water completely freed from CO_2. Freshly-prepared fibrine evolves CO_2. After all the CO_2 has been expelled by a rapid and abundant current of H, traces of CO_2 are again given off for several hours, and even days, under the influence of a slow current of H; it is possible that in this case also dissociation plays a part.

The above mentioned results were communicated by me to the Academy of Sciences at Amsterdam, at a meeting in January, 1871; when I also treated on the phenomena of gaseous exchange which take place in the lungs, and in the organism within the blood as well as beyond it. Some weeks previously my learned friend Dr. Lüdwig had presented to the Royal Saxon Society of Sciences (at a meeting on the 12th December, 1870) a memoir by J. W. Müller, "On the Tension of Oxygen in the Blood Corpuscles." This memoir, which has since been published, contains the record of two series of experiments made with great care and perseverance. (*a*). Blood poor in O was shaken up in a closed vessel with a known quantity of O. (*b*). Blood rich in O was shaken up in a closed vessel with a known quantity of N; and after equilibrium had been apparently obtained, the tension of O beyond the blood was compared with the proportion of O in the blood. The results would certainly have been more interesting if the method of experiment had admitted of the disposition of any desired temperature. Moreover, it was found that a complete equilibrium had not been obtained, because, when the O from the blood (*b*) was expelled, the proportion of O in that liquid compared with the tension beyond was far greater than at the time of the absorption of O (*a*). These experiments, however, bear directly on the important question to be solved, and they should be resumed, but with still smaller quantities of O, because even with 20 m.m. pressure of O saturation is nearly attained after a prolonged agitation; and it would hence appear that the equilibrium has been more completely reached in the series (*a*) than in (*b*). The exchange of gases in the blood is referred by Müller as well as myself to dissociation: and while Dr. Ludwig also adopts this view he states that it is not the oxygen which penetrates into the tissues, but that, on the contrary, the products of the decomposition of the tissues enter the blood to be completely oxidised therein. When I publish a full account of my experiments I shall again revert to this important point.

I will bring this essay to a close with a word on the difference existing between solution and chemical combination. I have called attention to the experiments of Debray on the dissociation of $CaCO_3$, by which he determined for different temperatures the tension of CO_2 corresponding to the mobile equilibrium. If the temperature continued to increase we might imagine, provided always that no further dissociation of the molecules of CO_2 nor of CaO takes place, that we should finally come to a condition in which, in conformity with Dalton's law, a constant volume of CO_2 was dissolved in molten lime no matter under what pressure, just as H and N are dissolved in water. Indeed, thermo-chemistry teaches us that a combination at different temperatures passes through all conditions which at one and the same temperatures are exhibited by different bodies. In this way the marked separation existing between solution and chemical combination disappears. The experiments of Roscoe and Dittmar (1859) are, in this respect, of great interest, as by them it was found that, in respect to water, ammonia at 0° is far from obeying Dalton's law; and also with regard to the experiments of Sims, in which it was made out that this only takes place towards 100°; while, according to the same authority, sulphurous acid does not obey the law in question except at temperatures above 40° (above 50° according to the figures published). The deviations are most marked for feeble pressures. It is probable that at a very low temperature, and under very low pressure, even CO_2 will not perfectly obey Dalton's law as regards its solubility in water.—*Archives Neerland. d. Sciences.*

ON THE ACTION OF CHROMIUM TRIOXIDE ON IODINE.

By I. WALZ, Ph.D.

A CONCENTRATED solution of chromium trioxide, when poured on iodine, turns rapidly dark, and assumes a syrupy consistence. The liquid thus formed does not respond to any of the reactions of free iodic or hydriodic acid. Spread in thin layers on glass plates it dries, in dry air, to a reddish-brown transparent varnish, which may be taken off in bright shining scales, which are hydroscopic, lose their lustre at a higher temperature owing to the dehydration, and when heated still higher are decomposed, oxygen and iodine being evolved, and green chromium oxide being left behind. Among the products of this decomposition is a volatile compound, of chromium and iodine, which seems to be decomposed at a temperature but little above that at which it is formed: if the scales before mentioned are heated to decomposition in a covered porcelain crucible, the heat being applied from the cover downwards, the inside of the latter will be found coated with green chromium oxide, resulting from the decomposition of this compound, in the isolation of which I was, however, not successful. At first I took these scales for a new and definite compound of iodine and chromium trioxide; but the analyses of the products of different preparations gave no uniform results, and I found that they were a mixture of chromium, chromium subiodate, and water in varying proportions.

If a solution of chromium trioxide and sulphuric acid be allowed to act on iodine, oxidation soon takes place, iodic acid being formed whether iodine be present in excess or not. I observed, however, that in no instance was all the chromium trioxide reduced to sesquioxide: in one instance a large excess of iodine and sulphuric acid was used, the contents of the beaker kept on the water-bath for a week, and allowed to become very concentrated every time before water was again added, and yet some chromium trioxide escaped reduction. To obtain the iodic acid pure, chromium sesquioxide is precipitated by sodium hydrate, the filtered solutions neutralised with nitric acid, and sulphuric precipitated by means of barium nitrate. The resulting solution is neutralised with sodium hydrate and chromic acid, precipitated by adding baryta water. The resulting colourless liquid contains only sodium nitrate and iodate, and the presence of the latter may be demonstrated by the usual tests, or it may be separated from the nitrate in various ways. Of course this method is far too laborious to become practically useful, but I deemed the reaction itself, and the few points noted in connection with it, worth communicating, as it has not, to my knowledge, been studied before.—*American Chemist.*

WATER ANALYSIS IN INDIA.

We have received from Dr. Macnamara a reply to a paper by Mr. Nicholson, published in our issue of August 9th. The subject has already occupied considerable space in our columns. In justice, however, to Dr. Macnamara, we give the chief points of his reply to Mr. Nicholson's criticism; and here we deem it expedient to end the discussion, as in our opinion its continuance can be of no practical interest to our readers. In his reply Dr. Macnamara says:—

"When I went home on furlough in 1869, finding that the Bengal reports upon the analysis of potable waters had been officially referred to Dr. Angus Smith for criticism, and finding that that gentleman had already made suggestions as to the methods of analysis which should be followed, I asked that I might be officially placed in communication with him, with a view to the conjoint compilation of a scheme of analysis for general use in India. To this request the Secretary of State consented, and subsequently suggested that with reference to the compilation we should put ourselves in communication with Dr. Parkes; so that from the commencement I was joined in the compilation of this scheme with Dr. Angus Smith, whom I need scarcely say stands in the very first rank of English chemists, and with Dr. Parkes, who is pre-eminently qualified to form an opinion as to the scope of a scheme designed to be a guide to the analysis of potable wuters for hygienic purposes.

"The scheme was compiled to be a guide to the examination of potable waters for hygienic purposes, not as a scheme for the minute and accurate analysis of waters generally; for indeed it is not needful to the determination of the fitness of a water for consumption to estimate in this way the whole of its constituents.

"Primarily the scheme was intended for the use of medical officers, who, having gone through the course of practical chemistry at Netley, might subsequently be called on to analyse potable waters in India; further, it was intended for use in the laboratory at Netley; and lastly, to aid professional chemists who might be employed in analysing waters in India,—not to direct them as to the details of the processes involved, but to indicate the nature and extent of the information which the Army Sanitary Commission, with whom this enquiry regarding potable waters originated, would require. Having these objects in view, the scheme is necessarily wanting in that homogeneity which one designed either for learners or for experienced chemists ought to possess. The scheme would not have been compiled had there been in existence any English manual on water analysis which would at once indicate all the information that would be required of the analysts, while it would not carry them into minute details of analysis which it was felt are not needed for the fulfilment of the special purpose in view.

"Mr. Nicholson is most severe upon the process for the determination of alkaline chlorides; he considers it so erroneous that because of it alone he would condemn the whole scheme.

"In estimating the salts of the alkalies in a water, it is usual to convert them into chlorides; and as a part of the alkali may exist in the form of sulphate, the conversion of the sulphate into chloride may be effected by the addition of chloride of barium to the water; the barium precipitates the sulphuric acid, while the chlorine remains in union with the potassium or sodium. But if the alkaline sulphates are present in only small amount, this conversion may be more conveniently brought about by the addition of chloride of ammonium to the solution, for on evaporation and subsequent ignition the ammonium carries off the sulphuric acid, leaving the chlorine in combination as chloride of sodium or of potassium. But Mr. Nicholson utterly denies this statement, and states that any one can convince himself by a simple experiment that it is an erroneous one.

"Well, if it were a fact that the conversion of alkaline sulphate into chloride cannot thus be brought about, the error in the present case would not lead to any very serious consequences, for against such the scheme particularly guards by its direction to use chloride of barium if the alkaline sulphate is in any quantity. But the statement involved in the directions given in the scheme is in truth quite correct; sulphate of sodium is decomposed, as every chemist should know, by ignition with chloride of ammonium. If Mr. Nicholson will place in a platinum capsule a little pure sulphate of sodium, then about twice as much chloride of ammonium, dissolve in water, evaporate to dryness, and ignite till all salts of ammonia have been driven off, I can promise that he will find in the residue abundance of chloride of sodium. Of course if an obvious precaution is neglected the experiment will fail; if the two dry salts are simply stirred up together in the capsule, and if then the capsule is placed over a spirit-lamp, the chances are that—the mixture not being a sufficiently intimate one—the whole of the chloride of ammonium will volatilise before the temperature rises sufficiently high to bring about the reaction. Authorities are with the scheme on this point. Fresenius, English edition of 1865, edited by Lloyd Bullock, at pages 98 and 101, states that the sulphates of potash and soda, ignited with chloride of ammonium, are converted into their respective chlorides. The edition of 1870, edited by Vacher, repeats the statement. The very process which Mr. Nicholson condemns is taken almost *verbatim* from Fresenius, and at page 542 of the edition of 1865 it is expressly stated that chloride of ammonium is to be added, 'to convert the still remaining sulphate of soda on ignition into chloride.' I will quote one more authority. In the lately published second edition of Sutton's "Volumetric Analysis," at page 287, this direction is given:—'If the water contains but little sulphate the baric chloride may be omitted, and a little ammonium chloride added.'

"Alluding to the molybdate of ammonium process, which is there recommended for the detection of phosphoric acid, Mr. Nicholson says—'It is one of the most untrustworthy known.' Noad, in his "Manual of Analysis," says of this test—'It is especially useful, as it enables the operator to detect the presence of phosphoric acid in minute quantities, in acid solutions of soils, fossils, &c.' Fresenius, in his direction for the qualitative analysis of water, gives this test only for the detection of phosphoric acid. Connington says the test is peculiarly fitted for the detection of small traces of phosphoric acid, as in minerals, soils, deposits from mineral springs.

Valentin orders it for the detection of the very minute traces of phosphorus in iron. I have myself used the test for many years, and have always found it reliable, and so searching that I do not hesitate to affirm that where this test fails to detect phosphoric acid in the residue, as ordered in the scheme, the presence of that body may safely be disregarded in an analysis made for the purpose of determining the fitness or otherwise of a potable water. I find, by experiment, that if the residue of say 100 c.c. of water contained 0·00002 grm. of phosphoric acid it would be readily recognised by the test, and even so little as 0·00001 grm. is recognisable if the test-tube and contents be allowed to stand some hours.

"The next point, in regard to which I have to defend the chemistry of the scheme, is in the matter of Mr. Nicholson's assertion that, in the process given for the detection of silica, the hydrochloric acid in the presence of nitrates would attack the platinum capsule, so that the residue would, in all probability, be one of platinum and silica. The scheme directs that hydrochloric acid be added to the concentrated water in slight excess, so that even at the commencement of the final evaporation there would be but a very small quantity of free acid in solution. One cannot open any work on chemical analysis without finding such a process; for instance, in Fresenius's edition of 1865, p. 542, this very process is given for the estimation of the silica in water, and the process follows immediately upon that for the estimation of nitric acid in the water.

"Mr. Nicholson complains, not of the principle of the method directed for the recognition of free carbonic acid in water, but that too large a quantity of lime water is directed to be used in applying it. It needs no such calculation as he has employed to prove, what would be patent to any one working the scheme, that a wrong figure had been retained in the text.

"Then Mr. Nicholson has a good deal of objection to make to the directions to evaporate the water down first in a porcelain capsule, and subsequently in a platinum dish. The point was fully considered, and we determined that, under the circumstances in which the operations would generally be conducted, the *alternative* plan as it stands in the scheme might very properly be recommended; and indeed, if the evaporation is not carried too far in the capsule, and if the transference is carefully conducted, the amount of silicates that will be taken from the capsule will be altogether inconsiderable. Of course if the analyst wishes to be very accurate in his estimation of silica, he will, as mentioned in the text, evaporate from first to last in a platinum capsule.

"Mr. Nicholson points out that, in the process for the quantitative estimation of silica, direction to evaporate to dryness, after the addition of the acid, has been omitted. It ought to have occurred to him, I think, that as the process is rightly given in the directions for the qualitative analysis for silica, its omission here was a mere oversight. If Mr. Nicholson will refer to the latest English edition of Fresenius, he will find that the detail dwelt on by him is there omitted in the process for the determination of silica in *potable waters*, while it is inserted in the more lengthy directions for the analysis of *mineral waters*. It has yet to be experimentally proved that the oversight alluded to would lead to serious error in the case of Indian waters.

"Regarding this, and other clerical errors which exist in the scheme, I may say I was prepared for them, for the manuscript, lined and interlined, was twice copied by mere copying clerks, so that I fully intended, on receiving a printed copy of the scheme in Calcutta, to go through the processes with the scheme before me in the laboratory, when any errors of the kind would have been at once discovered; but unfortunately, the very day I received a copy of the scheme, I also learned that Government had decided to stop water analysis in military cantonments in this presidency, intelligence which so vexed and disappointed me that I put the scheme altogether aside.

"As regards the criticisms upon the 6th Bengal Report upon the analysis of potable waters, I did not compile it; its defence may be left to those who did.

"It is much to be regretted that systematic water analysis is for a time stayed in Bengal, for the new methods of analysis introduced by Messrs. Wanklyn and Chapman are so immeasurably superior to those formerly used, that they certainly ought to be applied to the examination of every important potable water regarding the purity of which there can be any room for doubt."

ON THE

PRODUCTION OF FURFUROL BY THE ACTION OF SUPERHEATED WATER UPON WOOD.

By HUGO MÜLLER.

In confirmation of the results described by Mr. Greville Williams respecting the formation of furfurol by the action of superheated water on wood, I may be permitted to mention some observations which I made some time ago whilst carrying out some experiments on the production of paper-pulp from wood.

In the course of these experiments, I had occasion to examine the action of water on various kinds of wood at a temperature varying from 120° to 180° C., and I then noticed that the resulting aqueous extract exhibited invariably a strong odour resembling very much that of furfurol. Having occasion during last summer to repeat the same kind of experiments with bamboo, I observed the formation of this furfurol-like odour in a still more pronounced and unmistakable degree; and I felt accordingly induced to submit the obtained aqueous extract to a special distillation in order to get some direct proof of the actual presence of furfurol.

Although the quantity of bamboos in this particular experiment amounted to not more than 200 grms., I obtained, after two distillations, an appreciable quantity of a heavy oily liquid, which exhibited all the properties of furfurol, and which on being brought into contact with ammonia at once gave rise to the formation of the well characterised furfuramide.

It would appear from these experiments that superheated water shares with dilute sulphuric acid and chloride of zinc the power of splitting up the peculiar substance recognised by Gudkow some time ago as the furfurol-yielding constituent of all vegetable tissues.

Although the aqueous extract containing the furfurol exhibits a strong acid reaction caused by the presence of some peculiar organic acids, I do not think that the formation of furfurol in this case is due to the action of these acids; on the other hand, I may mention that in treating wood with caustic soda lye instead of pure water, the formation of furfurol appears not to take place.

NOTE ON LITMUS-PAPER.*

By EDWARD R. SQUIBB, M.D.

The rapid progress of medical science, and the consequent improvement in the art of medicine, renders the modern physician much more critical and accurate in his investigation and observation of diseased conditions; and for the means by which to attain greater accuracy and precision in his observations and researches he properly and naturally looks to the pharmacist. In this way, within the past few years, litmus-paper has become an important, if not indispensable agent to the intelligent physician, and he often seeks it, but rarely finds it in the hands of the pharmacist. And when found, it is rarely of the quality or in the condition best adapted to his uses.

* Read before the American Pharmaceutical Association.

When the physician and pharmacist buy litmus-paper, they generally make the same mistake that the photographer does, and demand that it shall be deep in colour; that the blue shall be very blue, and the red very red. This is wrong in principle and in practice, particularly for physicians' uses, where slight traces of alkalinity or acidity are often important, and the palest instead of the deepest paper should always be selected. The solution made from 1 lb. of good litmus commonly requires about 200 grains of concentrated sulphuric acid to saturate it up to the point at which the colour *begins* to change to purple in its course toward redness, and this purplish tinge of pale blue, and the corresponding purplish tinge of pale red are the desirable colours, between which is the least margin of difference which is left undetected by the testing.

This large proportionate quantity of sulphuric acid indicates how comparatively roughly the carelessly made and deeply coloured litmus-papers fulfil their design; and it is the object of this note to indicate a better practice, and a better state of knowledge on this subject. To prepare good litmus-paper, the following formula may be useful:—

Take of—

Good litmus, in fine powder	1 part.
Water	4 parts.
Alcohol	1 part, all by weight.

Put these ingredients into a bottle, and shake the mixture occasionally during 24 hours; allow the sediment to settle out completely, and decant as much as possible of the clear liquid into another vessel; then put the same quantity of water and alcohol upon the sediment, shake again, and when again well settled, pour off the clear liquid for use in diluting the first portion of liquid, or for dissolving a fresh portion of litmus. Separate about one-fourth part of the first clear liquid, and add to the remainder dilute sulphuric acid until it becomes of a purple tint, or gives a purplish-blue colour to a slip of white paper; then add about one-half of the separated fourth part of the solution, and if this should entirely restore the original pure blue colour, again add diluted acid until a purplish tint is again obtained; then add the remaining eighth part of the original solution to restore the pure blue colour, or which is more delicate as a test for acidity, a very faintly purple-blue colour; then dilute this solution either with water, or with the second liquid from the litmus sediment until a slip of neutral white paper dipped into it has a pale blue or pale purplish-blue colour. Here it is necessary to remember that this paper when dry is many shades paler than when wet, and the dilution should be made accordingly. The solution for making red litmus-paper will not bear the same amount of dilution as that for the blue, and must be made of the proper purplish-red colour by the addition of dilute acid before dilution. The solutions so made will keep almost indefinitely, and may be passed on from one process to the next. The paper should be made from pure rag stock —not from bleached wood nor straw—should be quite white, and above all, must be quite neutral, and show no red spots or blotches when moistened with the blue solution. French or German filtering-paper commonly answers well if of good quality. This is cut into convenient size, the larger the better, because there is less waste, and held by two corners, which corners are to be kept dry; it is to be skilfully laid on the surface of the solution, first one side and then the other, then drained, and hung over clean glass tubes to dry. The vessel to hold the solution for dipping should be larger than the sheet of paper, and shallow.

The sheets when dry are laid together, and the edges trimmed off all round. They are then cut into sheets 3 to 4 inches wide and 12 to 18 inches long, according to the size of the paper used. What is sold as "a sheet of litmus-paper," should never be less than 4 inches by 12, or 3 by 18. Such a sheet cut lengthwise through the middle gives a strip which when cut crosswise into strips a quarter or three-eighths of an inch wide, is of a very convenient size and form for use. The sheets, one paler and one deeper of the same colour, if desired, should be rolled up together in a tight roll, slipped into a test-tube and corked. An ordinary 5-inch test-tube holds the sheets conveniently, and one such tube of the red and one of the blue, properly labelled, forms a convenient pair, such as is supplied to the U.S. army by the writer. Formerly these sheets were enveloped in tin-foil; but though they thus keep much better than in paper, they are when pale and delicate very liable to be changed and spoiled by the alkaline and acid vapours in the air. In corked test-tubes they keep unchanged for an indefinite time, while the test-tubes and corks when empty are always worth their cost to those who use litmus paper.

In this form of sheets, however, the paper is not so convenient for the physician as when cut into strips 1 to 2 inches long and a quarter of an inch wide; and the writer finds that about 100 of such strips, put up in a wide-mouth tube vial, corked and properly labelled, is a most convenient and popular form for physicians' use. One such vial of each colour put up together forms a pair which no physician should be without. And most physicians will buy them if they can get them. These convenient little strips may be shaken out of the vial as wanted for use, but as the fingers should, by rights, never touch any other strip than the one taken, it is best to take them from the vial by a pair of forceps from the physician's pocket-case.

ON A

NEW APPLICATION OF TUBE HYDROMETERS.

By WILSON H. PILE, M.D.

In an article read before the American Pharmaceutical Association in Baltimore, 1870, I endeavoured to render intelligible a new method by which the relation between the degrees of Baumé's hydrometer and specific gravity could be easily determined; and, as the method there pointed out is intimately connected with the present subject, I will briefly recapitulate the main points.

A plain cylindrical tube of thin glass, closed at its lower end, is to be immersed in pure water, at a temperature of 60° F., and then loaded by pouring in shot or mercury until it sinks about two-thirds of its length in the water, the point to which the surface of the water rises being then marked on the tube. If now that part of the tube which was immersed in the water be divided into 145 parts, and these parts numbered from the top downwards, the tube will represent a Baumé's hydrometer for liquids heavier than water, and by floating it in any liquid of greater density than water its degree will be seen on the tube at the surface of the liquid.

These degrees can be marked on paper, and the paper inserted in the tube and pushed down to the bottom, the upper mark, or zero, being exactly opposite the mark which had been previously made on the tube.

We will now proceed to show a new application of these tube hydrometers in determining densities.

Having immersed a tube, closed at the lower end as before, in water, we pour water into the tube until it sinks about two-thirds of its length.

It should float upright. We are now to mark the surface of the water in which the tube floats, and also the surface of the water within the tube. The tube below this latter mark must then be divided into 145 parts, either by etching on the glass or—what is more practical —by drawing a scale on paper, numbering the degrees from the top (0°) downwards. In ascertaining the density of any liquid heavier than water, the tube must be emptied, and dried by rinsing with alcohol and drawing air through it by means of a long tube, then immersed in water of 60° F., and the liquid to be tried poured in until the tube sinks to the upper mark. It can then be taken out, and

the degree of density shown on the tube, if it be etched, or else by holding it on the paper scale in its proper position.

Our illustrations have been thus far for liquids heavier than water; for those lighter than water the tubes or scales require a different division. Unfortunately, Baumé's method of dividing his hydrometers rendered the degrees for those of light liquids larger than those for heavy liquids, and by comparison we find they are in the ratio of 145 to 140. In order, therefore, to make a scale for light liquids, we divide the space below the surface of the water within the tube into 140 parts, instead of 145 parts as at first; the degrees are then continued upwards 70 or more parts. These divisions are numbered at the water point 10° (another peculiarity of Baumé's scale, and running upwards as high as desired. The scale below the water point need not be marked, as it can be only used for liquids lighter than water.

The tube is used for all liquids in the same manner, namely, by pouring into it the liquid to be tried until it sinks in water down to the mark made at first on the tube; then by holding it against the paper scale marked as just described. The surface of the liquid will indicate its proper degree of density.

An advantage which the tube when used in this manner possesses, is the small quantity of liquid necessary, as the tube can be made quite small in diameter, and by increasing its length the degrees are rendered larger, and thus greater accuracy is obtained. It may also be employed in ascertaining the density of extremely heavy liquids, where no hydrometer could be found of service.

ON THE DETERMINATION OF THE TRUE ZERO OF THERMOMETERS.

By Ch. TELLIER.

It is generally admitted that the o° of the Centigrade and Réaumur thermometers varies after a longer or shorter time, and the delicate and sensitive thermometers therefore become altered as regards the indication of the o° when placed in melting ice or snow. According to the observations on the supersaturation of water with cold (see Chemical News, vol. xxvi., p. 107) thermometers are much less variable than is generally supposed, and the cause of the differences which are observed is probably due to an error made in the determination of the o°. It may be readily conceived that unless special precautions are taken at the time of the graduation of the thermometer, the water in which it is plunged, and which is supposed to be precisely at the temperature of melting ice, may in reality be slightly above that temperature; this is the case if the walls of the vessel containing the water and ice admit more heat to the water than the melting ice can overpower: this is natural; ice does not melt instantaneously, but only in the ratio of its surface, and in proportion to the difference of the temperature of the water in which it floats, and its own temperature; and it is consequently quite possible that the water which contains the ice is not at a temperature of o°. The colder the water the more slowly will equilibrium of temperature be established between the two bodies, and in the same ratio will the chances of error be greater. The error of indications of the thermometers brought on by time either depends upon a modification in the glass, as usually admitted, or it is due to the result of an erroneous estimation of the o°. In the first case the alteration would rather tend to *plus* in one case and to *minus* in the other, and there is no plausible reason why it should be otherwise; in the second case (erroneous estimation of the o°) the error should be always *plus*, because the water must be above o°. My experiments have confirmed these views. I have taken seven thermometers with the graduation engraved on the stem and made by one of the best makers; only one of these instruments has been found to indicate o° correctly, all the others indicated a difference—

2	indicated	+ 0·1
1	,,	+ 0·2
2	,,	+ 0·3
1	,,	+ 0·4

Not one of these thermometers indicated below o°.

The determination of the o° by placing the thermometer in melting ice is therefore not an absolutely certain method of operating. In order to find the true o° another plan must be followed, which is that found and described by me, and called *terminus of congelation*. The operation is carried on as follows:—A glass vessel is placed in a refrigerating mixture, and the temperature of the water contained in the vessel is thereby readily lowered to −2 or to −3: this having been done, the vessel is removed from the mixture, and the thermometers to be graduated are placed in it, with a small piece of ice; hereby the water becomes suddenly frozen, while at the same time the temperature rises to o°. When one has no ice at hand, and in order not to complicate the operation, the temperature of the water should be brought down to −4°, when, by giving a gentle tap with a glass rod to the bottom of the vessel, the phenomenon of congelation of the water will be observed, the temperature rising to the true o° absolutely. I draw from the foregoing the two following conclusions:—

1. That the expression of melting ice does not exactly indicate the true o°, and that therefore it ought not to be the basis of the determination of that point.

2. That by applying the term of *terminus* of congelation it is quite possible to estimate with certainty the exact point which separates liquid water from ice, and that point is the true o°, which should be the starting point of the graduation of the thermometer scale.—*Revue Hebdomadaire de Chimie.*

CORRESPONDENCE.

TELEGRAPHIC EXPERIMENT.

To the Editor of the Chemical News.

Sir,—The following experiment may interest your readers.

On November 4th the cable from Dover to Boulogne was broken by a ship's anchor, about 5 miles from Dover. By the kind permission and co-operation of Mr. Bourdeaux, the engineer of the Submarine Telegraph Company, I placed my instrument (as shown lately before the Society of Arts, and described at the time in your Journal) between the end of the broken cable at Dover and the water-pipes of the town. To our surprise we could distinctly read every message to and from Ostend, Calais, and Dover, on the Dover-Ostend, and Dover and Calais cables. The explanation was as follows: —Part of the electrical current which went to earth at the Dover water-pipes went on to a second earth formed by the end of the broken cable, and in its passage made signals on the instrument. Thus the enormous fault formed by the Dover water-pipes was not sufficient to prevent a perceptible current of electricity passing on to the broken end of the Dover and Boulogne cable.

We also asked the French operator at Boulogne to send a current through the broken cable, and got a feeble result; but as we were not able, without special authorisation from the French Government, to get him to put on such batteries and instruments at Boulogne as were necessary, and the remaining cables were fully occupied with messages, we did not follow out this portion of the experiment. The first experiment, however, shows what an enormous fault may exist without preventing the action of

the delicate instrument, which I described in a former number of your Journal.—I am, &c.,

H. Highton.

Putney, November 12th, 1872.

PREVENTING EXPLOSIONS IN COAL-MINES.

To the Editor of the Chemical News.

Sir,—By way of addition to my note "On a Means of Preventing Explosions in Coal-Mines," inserted in the Chemical News for October 25th, I beg leave to remark that in many mines the process of periodical partial exhaustion by air-pumps, followed by forcing a powerful current of air through the entire workings of the pit, would probably prove sufficient to prevent any dangerous accumulations of gas. For this purpose it would merely be necessary to have two iron plates (with suitable stop-cocks) one to cover each shaft, and to connect one or both of these with air-pumps, so as either to partially exhaust or drive in air at pleasure.—I am, &c.,

John A. R. Newlands, F.C.S.

9, Mincing Lane, E.C.,
November 18, 1872.

CONSTITUTION OF MATTER.

To the Editor of the Chemical News.

Sir,—Before proceeding to examine Mr. Kingzett's "objections to my arguments," I will attempt to state more fully the primitive acts and ideas on which those arguments were founded.

Matter viewed from a *physical* point of view is, in its nature, *one*. It is seen to possess the common properties of weight, extension or form, and stability, all other properties being merely conditions. It is composed of inconceivably minute particles, or atoms, which possess, like the masses of matter they compose, the common properties of weight, form or extension, and stability; but they also possess another property, of which masses of matter are destitute, viz., indivisibility. They are not alike in size or weight, but exist in great diversity of both.

Being not composed of parts, it is impossible to diminish their size by friction or "wearing" (which is a rubbing off of atoms), or by breaking (which is the act of opening matter where molecular divisions already exist); and it is impossible to increase their size by the addition of matter, because they are inflexible, and two atoms will not amalgamate together to form a larger atom (placing two atoms in contact would no more be increasing the size of one of the atoms than placing two marbles in contact would be increasing the size of either of the marbles). It is also impossible to increase their size by expansion by heat (which is the act of increasing the inter-atomic spaces of a mass of matter), because they are not composed of atoms, and have no inter-atomic spaces; and it is possible to decrease their size by cold (which is the act of decreasing the inter-atomic spaces) from the same reason.

Therefore the various atoms always retain their respective sizes, under whatever conditions the masses of matter they compose may be placed.

These variously-sized atoms, when collected into masses in their respective sizes, constitute and form a number of bodies which we call chemical elements. Each mass, owing to the different size of its component atoms, and the consequent different effect of the forces on these atoms, exhibits, when compared with the other masses, certain marked differences in its behaviour, which differences are called chemical properties. It is seen that, if all the forces could be withdrawn, "we should have matter reduced to (chemical) simplicity," because matter would then present one uniform absence of chemical properties.

But one element can never be converted into another; because, though the play of the forces developes chemical properties, yet the atomic sizes which influence the play of the forces can never be altered by the alteration or "withdrawal of the forces."

Mr. Kingzett thinks I have "made a serious error by saying the withdrawal of the forces cannot alter the atomic sizes." "Would it not," says he, "be wiser to say the atomic size is an effect of force? For, if not, the atomic volume at 100° C. would be the same as at 0° C." Mr. Kingzett has here been guilty of "confusing matter and force." The increase in volume caused by the heat is not due to an increase in the size of the atoms, but to an augmentation of the inter-atomic spaces. Whether I have demonstrated the "most important fact," that the atoms are incapable of alteration in size, I leave it for Mr. Kingzett to consider. By mechanical means, such as crystallisation, heating from a low to a high temperature, &c., it is possible to alter the molecular arrangement, but not the chemical nature, of an element. For instance, "the diamond, graphite, and charcoal are constituted of the same matter, though the qualities of each are very different; the difference arises from molecular arrangement, or, in other words, from the ultimate particles being differently operated upon." "Yet we can burn all three forms into CO_3;" which proves the identity of the chemical nature of the three forms, in spite of the fact that their "particles are differently operated upon."

To the rule that chemical nature depends on the atomic sizes, there are five known exceptions; yet a very slight difference in the form of the atom, or an exceedingly fractional error in the estimation of the atomic weight, would be sufficient to account for a difference in the chemical behaviour of two bodies whose atoms are supposed to be of the same size.

"If," asks Mr. Kingzett, "atoms are not composed of atoms, what are they composed of?" This would lead one to conclude that Mr. Kingzett advocates the antiquarian theory of the infinite divisibility of matter; he did not pay sufficient attention to the word *ultimate*, which preceded the word *atom*.

If he finds a difficulty in conceiving the idea of an atom possessed of extension and devoid of divisions, I find an equal difficulty in forming any conception of an atom containing an infinite number of divisions yet possessed of stability. Divisions are space, and where space exists matter is not. Therefore, if the divisions or spaces are infinite, there is no room for matter left; or, in other words, matter cannot exist.

"If," says Mr. Kingzett, "matter cannot exist without force, then force must exert an influence over matter under any circumstances,—therefore the size or volume of atoms is influenced by force." Mr. Kingzett places a dash between the words "circumstances" and "therefore." What mysterious train of thought is this intended to represent? I confess I am unable to see it.

Mr. Kingzett should recollect that, if "all the forces could be withdrawn, we should have matter," not annihilated, but "reduced to simplicity;" and therefore matter can exist without force.—I am, &c.,

John F. Sutton.

MISCELLANEOUS.

Indian Cinchona Alkaloid Factory.—We understand that Dr. Simpson of Patna, has declined the superintendence of the Cinchona Alkaloid Factory at Rungbee, in Sikkim, and that the Indian Government have sent home for some one to fill the appointment. We hope that an experienced chemist will be appointed.

Chemistry at Cambridge.—The Master and Fellows of Gonville and Caius College at Cambridge have recently determined to appoint a Prœlector in Chemistry to superintend the College Laboratory, and to have charge of the chemical studies of the students there. The stipend will be £200 a year, and the Prœlector will have the ordinary

status of a Fellow of the College. The election will take place about the middle of next month.

Royal Society.—The Medals in the gift of the Royal Society have this year been awarded as follows:—The Copley Medal has been awarded to Professor Friedrich Wöhler, of Göttingen, For. Memb. R.S., for his numerous contributions to the Science of Chemistry, and more especially for his researches on the products of the decomposition of Cyanogen by Ammonia; on the Derivatives of Uric Acid; on the Benzoyl Series; on Boron, Sillicon, and their compounds; on Titanium, and on Meteoric Stones. A Royal Medal has been awarded to Prof. Thomas Anderson, M.D., for his investigations on the Organic Bases of Dippell's Animal Oil; on Codeine; on the Crystallised Constituents of Opium; on Piperin and on Papaverin; and for his researches in Physiological and Agricultural Chemistry. A Royal Medal has been awarded to Mr. Henry John Carter, F.R.S., for his long-continued and valuable researches in Zoology, and more especially for his inquiries into the Natural History of the Spongiadæ. The Romford medal, awarded every two years, has been awarded to Anders Jonas Angström, For. Memb. R.S., for his Researches on Spectral Analysis. The annual meeting of the Fellows of the Society, for the election of Officers and Council for the ensuing year, will be held on the 30th inst. We understand that Prof. Huxley has been nominated by the Council as successor to Dr. Sharpey, who, after a long period of service as Secretary, resigns his office.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, November 11, 1872.

This number contains the following original papers and memoirs more particularly relating to chemistry:—

Composition of Chloride of Lime.—J. Kolb.—The contents of this paper relate to researches made by the author in 1867, and then published in the above-named periodical, as well as in the *Annales de Chimie et de Physique*. These researches are here referred to to correct some errors which the author considers were contained in a paper by Dr. Crace Calvert, published in the *Comptes Rendus* of 27th May last.

Causes of the Loss of Sodium in Leblanc's Soda-Making Process.—A. Scheurer-Kestner.—After first referring to his former essay on this subject (see Chemical News, vol. xxii., p. 267), the author states that the loss of sodium retained in the waste increases proportionately with the quantity of chalk employed. When for 100 sulphate of sodium the quantity of chalk amounts to 98, the quantity of sodium retained in the waste is 0·59 per cent; for 102 chalk to 100 sulphate of sodium, 0·86 per cent; for 111 chalk to 100 sulphate of sodium, 1·30 per cent. The greater part of the excess of chalk is converted during the calcination process into lime; and when the crude soda is lixiviated with water, the lime, while becoming hydrated, reacts upon the carbonate of sodium, and thereby renders a portion insoluble in water. According to a series of experiments made by the author, the lime may retain even as much as from 4·75 to 4·95 per cent of soda, calculated dry. The greater or less porosity (density) of the ball-soda also exerts some influence; the waste from porous ball-soda was found to contain 1·44 per cent, that from dense ball-soda 1·97 per cent of soda. In order to diminish as much as possible the loss of sodium, the quantity of chalk to be employed should be reduced as much as possible, and the thoroughly calcined mass should be withdrawn from the furnace when it gives off copiously carbonic oxide gas, which is only formed when the operation is nearly finished; the evolution of this gas being due to the action of the coal upon the limestone compound, viz., reduction of the carbonate to caustic lime.

Neutral Combinations of Mannite and its Hydrates.—G. Bouchardat.—This essay treats on dichlorhydric mannite—

$$C_{12}H_2(H_2O_2)_4(HCl)_2,$$

a crystalline body soluble in cold water, insoluble in absolute alcohol and ether; fuses at 174°, but is then also decomposed, as is also the case when it is dissolved in boiling water, the result being the formation of monochlorhydric mannitane and HCl. The former is a neutral compound readily soluble in all proportions in water, alcohol, and in ether. When dichlorhydric mannite is treated with nitro-sulphuric acid, it is converted into hydro-chloro-nitro mannite, a solid substance insoluble in water, soluble in alcohol, not explosive; dibromhydric mannite, $C_{12}H_2(H_2O_2)_4(HBr)_2$, also a solid body insoluble in cold water, alcohol, and ether; fuses at 178° with decomposition, which also ensues when this compound is treated with boiling water, thereby yielding monobromhydric mannitane, $C_{12}H_3(H_2O_2)_5(HBr)$, a compound readily soluble in water, alcohol, and ether.

Researches on Santonine.—L. de Saint Martin.—Santonine is the active principle of the *Semina santonici*. The author has investigated santonine with the view of establishing its chemical character. If santonine is really a phenol its formula, $C_{30}H_{18}O_6$, indicates that it must yield by reduction:—(1) a diatomic phenol, $C_{30}H_{18}O_4$; (2) a monoatomic phenol, $C_{30}H_{18}O_2$; (3) a hydrocarbon, $C_{30}H_{18}$. The author has prepared, by treating santonine with zinc filings at a high temperature, santonol—a phenol $C_{30}H_{18}O_2$—which in a pure state is similar to stearine, and fuses at 135°. It is insoluble in water, readily soluble in alcohol and ether, yielding with sulphuric acid a sulpho-conjugate compound.

Researches on the Functions and Transformation of Mouldiness.—A. Béchamp.—This lengthy essay contains the record of a series of experiments made with the view to prove that, chemically, mouldiness is ferment, and that there exists in that respect no real difference between the cryptogamic plants, vulgarly termed mouldiness and yeast.

Fermentation of Fruit.—G. Lechartier and F. Bellamy.—This paper treats at length on the changes which fruit, apples, pears, cherries, potatoes, and chesnuts undergo when kept for a long period in closed vessels. It appears that previous to becoming quite rotten, fruit yields under these conditions alcohol and carbonic acid; which is also evolved from grain and from linseed when sufficiently moist, and kept under the same condition for a long time.

Estimation of Manganese in Soils and in Plants.—A. Leclerc.—Reserved for full translation.

This number contains a series of papers relating to the discussion on fermentation, and a number of papers relating to astronomy, meteorology, geology, botany, physiology, and anatomy.

La Revue Scientifique de la France et de l'Etranger, November 16, 1872.

This number contains no papers relating to chemistry, but we call attention to the following memoir:—

The Troglodytes of Vezère.—P. Broca.—The illustrated account of an extinct race of mankind, of which fossil remnants are found at and near Vezère. There is added to this memoir an account of the excursion from Bordeaux to Eyzies, during the meeting of the French Association for the Advancement of Science, for the purpose of visiting the bone cavern.

Revue Universelle des Mines, de la Metallurgie, des Travaux Publics, des Sciences et des Arts Appliqués à l'Industrie, June, 1872.

In addition to several original papers strictly relating to engineering and collateral subjects, this number contains an exhaustive memoir—

Chilian Amalgamation Method.—E. Fonseca.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, November 7, 1872.

Review of the Contents of the International Exhibition Held at Paris in 1872.—C. Mène.—This first portion of a review of the exhibition of products of domestic economy treats, in the first place, on the origin and history of the exhibition, and, next, on the objects sent in from La Martinique, one of the French colonies.

Manufacture of Perfumed Soaps.—MM. Beyer Brothers.—An illustrated account exhibiting the machinery and tools for the industrial preparation of perfumed soaps.

Improved Method of Obtaining Sea-Salt.—M. Roulleau.—The author describes the method of construction of the so-called salt-gardens, so as to obtain by one evaporation of sea-water (spontaneous evaporation by exposure to open air) a clean and white-coloured salt, this method of construction being especially adapted to sandy and marshy sea-shores.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 16, 1872.

Before proceeding with the ordinary business of the meeting of this society, the President, Dr. A. W. Hofmann, announced that the Runge memorial monument, the erection of which was first proposed by this society, was finished, and would shortly be placed in the cemetery at Oranienburg; the monument is beautifully executed.

This number contains the following original papers and memoirs:—

On Kieserite, its Properties and Applications.—H. Grüneberg.—Kieserite, ($MgSO_4,H_2O$), is a native product of the Stassfurt saline deposit, and is distinguished from the ordinary sulphate of magnesia, ($MgSO_4,7H_2O$), by its being less soluble in water. The author describes at length the industrial method applied at Stassfurt for purifying this salt, so that it is sent off at 60 per cent $MgSO_4$, it being

extensively used for dressing cotton and other textile fabrics at Manchester. A large quantity of kieserite is employed in winter for preparing, by double decomposition at a low temperature, sulphate of soda from common salt; the kieserite is also used as manure, and the author has succeeded in making a double salt of kieserite and gypsum, which—prepared by first mixing the two salts together, igniting this mixture, and next treating it with cold water—yields a hard marble-like mass, which, when pulverised and mixed with water, may be moulded in any shape, rapidly becoming as hard as stone, and unalterable by atmospheric agency.

The Liebenfrauensee at Kissingen.—C. Bender.—It appears that there is situated near Kissingen a small lake (size of surface, 1076 square metres), from which gas is permanently evolved in rather large bubbles; this gas was found by the author to consist, in 100 parts, of—Nitrogen, 84·6 per cent, and oxygen, 15·4; while the gas absorbed by the water was found to consist, a deduction being made for carbonic acid, of—Nitrogen, 74·7 per cent, and oxygen, 25·3. Assuming that in every second one gas-bubble of 10 c.c. is evolved per square metre of surface from this sheet of water, the quantity of nitrogen evolved in the atmosphere amounts per second to 9·1 litres. The author describes at length, and illustrates with woodcuts, the ingeniously-contrived apparatus employed by him in making these researches on the spot.

On Quercite-Sulphuric Acid, and on a Kind of Sugar Separated from it which Differs from Quercite.—C. Scheibler.—Braconnot discovered in acorns in the year 1849 a peculiar kind of sugar, termed quercite, which has the formula $C_6H_{12}O_5$, and of which Dessaignes (*Ann. d. Chem. u. Pharm.*, vol. lxxxi., p. 103) states that it yields with sulphuric acid a conjugate quercite-sulphuric acid. The author has recently prepared quercite and this acid in larger quantity, and says that the barium, calcium, zinc, cadmium, and copper salts of this acid are all amorphous resin-like materials. The aqueous solution of the barium salt, when heated to from 120° to 130° in a sealed tube, is split up into sulphate of baryta, free sulphuric acid, and a new kind of sugar, which is not quercite, and which the author believes to be identical with mannite or dulcite, and to be formed from quercite by taking up 1 molecule of water; further researches are, however, being made.

On Pheno-Chinon aud Similar Compounds.—H. Wichelhaus.—After first referring to his former researches on the oxidation of phenol (see Chemical News, vol. xxv., p. 190), the author records in this memoir, elucidated by a lengthy series of complex formulæ, his researches on pyrogallo-chinon, chinhydron, pheno-chinon, and purpuro-gallin, the formulæ of which are, respectively—

1. Purpuro-gallin.—$C_{18}H_{14}O_4 = C_6H_4\begin{matrix}O.O.C_6H_5\\O.O.C_6H_5\end{matrix}$
2. Pheno-chinon.—$C_{18}H_{14}O_6 = C_6H_4\begin{matrix}O.O.C_6H_4.OH\\O.O.C_6H_3.OH\end{matrix}$
3. Chinhydron.—$C_{18}H_{14}O_8 = C_6H_4\begin{matrix}O.O.C_6H_3(OH)_2\\O.O.C_6H_3(OH)_2\end{matrix}$
4. Pyrogallo-chinon.—$C_{18}H_{14}O_9 = HO.C_6H_3\begin{matrix}O.O.C_6H_4(OH)_2\\O.O.C_6H_3(OH)_2\end{matrix}$

The author further treats on the reaction between pheno-chinon and aniline, whereby a body identical with chinon-anilid is formed.

New Phenol-Sulpho Acid.—J. Post.—After briefly referring to the researches of Kekulé, Kolbe, and Gauhe on phenol-sulpho acids obtained from nitro-phenol, the author states that he has obtained, by treating orthonitro-phenol, which fuses at 110°, with fuming sulphuric acid, a new phenol-sulpho acid different from those hitherto known. The lime salt of this substance is a solid crystalline body; formula—

$$C_6H_3\left\{\begin{matrix}NO_2\\O\\SO_2O\end{matrix}\right\}Ca+2\tfrac{1}{2}H_2O.$$

The composition of the baryta salt is similar to that just mentioned, but the acid itself has not been isolated in pure state.

On some of the Derivatives of Uramido-Dracylic Acid.—P. Griess.—This essay treats on nitro-amido-dracylic acid—

$$C_7H_4(NO_2)(NH_2)O_2,$$

a solid, crystalline, deep yellow-coloured body, difficultly soluble in boiling water, but more readily so in boiling alcohol. The barium salt of this acid has in air-dry state the formula—

$$(C_7H_3(NH_2)(NO_2)O_2)_2Ba+5H_2O.$$

The author further refers to the action of tin and hydrochloric acid upon nitro-amido-dracylic acid, on oxynitro-dracylic acid, and on *β*-oxynitro-benzoic acid.

Structure of Isomorphous Crystals.—H. Baumhauer.—A crystallographical essay.

Means of Regulating Gas-Flames so as to Obtain a Constant Temperature Higher than that of the Boiling-Point of Mercury.—J. Myers.—Reserved for full translation.

New Hydrocarbon Isomeric with Anthracen.—C. Graebe.—When crude anthracen is treated with benzol or sulphide of carbon, the filtrate of these solutions contains several hydrocarbons, only one of which, viz., acenaphthen, has been isolated and studied. It appears that Dr. Glaser, while working with crude anthracen on the large scale, has found a new hydrocarbon, which he has sent to the author for further investigation. The new compound, $C_{14}H_{10}$, is in many respects akin to anthracen; it crystallises, exhibits fluorescence, fuses at 105°, boils at 340°, is hardly soluble in cold, more readily so in hot, alcohol, and is very soluble in benzol, ether, and sulphide of carbon; vapour density, 6·28 (theoretically 6·16); it combines with picric acid, and behaves like anthracen with chromic acid.

Chlorine Derivatives of Aceton.—C. Bischoff.—This exhaustive monograph is divided into the following sections:—Introduction, containing a concise *resumé* of the labours of other *savants* on this subject; monochlor-aceton-cyanhydrogen; monochlor-acetonic acid; salts of this acid.

Mono-Oxyanthrachinon and Anthraflavinic Acid.—C. Liebermann.—The results of the author's renewed investigation of these bodies; these results agree with those published in the *Ann. d. Chem. u. Pharm.*, vol. clx., p. 141.

Decomposition of Nitrated Anisols by Ammonia, and on the Constitution of Tri-Amido-Benzol.—H. Salkowski.—Notwithstanding its high scientific value, this essay is not suited for abstraction.

Action of Phosphoric Perchloride upon Sulphon Acids.—G. A. Barbaglia and A. Kekulé.—It appears from the researches recorded in this essay that the sulpho group of the phenol-sulphon acids is decomposed by phosphoric perchloride, with the formation of thionyl chloride—

$$C_6H_4\left\{\begin{matrix}SO_2H\\OH\end{matrix}\right.$$

yields—

$$C_6H_4\left\{\begin{matrix}SO_2Cl\\OH\end{matrix}\right.$$

and next—

$$C_6H_4\left\{\begin{matrix}Cl\\OH\end{matrix}\right.$$

and then—

$$C_6H_4\left\{\begin{matrix}Cl\\Cl\end{matrix}\right.$$

while, at the same time, there is formed—

$$C_6H_4\left\{\begin{matrix}Cl\\O.PO.(OH)_2\end{matrix}\right.$$

On some of the Substitution Products of Dimethylaniline.—G. Krell.—This essay treats on—Monochlor-dimethylaniline—

$$\left.\begin{matrix}C_6H_4Cl\\CH_3\\CH_3\end{matrix}\right\}N;$$

dichlor-dimethylaniline—

$$\left.\begin{matrix}C_6H_3Cl_2\\CH_3\\CH_3\end{matrix}\right\}N;$$

trichlor-dimethylaniline—

$$\left.\begin{matrix}C_6H_2Cl_3\\CH_3\\CH_3\end{matrix}\right\}N;$$

dinitro-dimethylaniline—

$$\left.\begin{matrix}C_6H_3(NO_2)_2\\CH_3\\CH_3\end{matrix}\right\}N;$$

and trinitro-dimethylaniline—

$$\left.\begin{matrix}C_6H_2(NO_2)_3\\CH_3\\CH_3\end{matrix}\right\}N;$$

Bayerisches Industrie und Gewerbe-Blatt, October, 1872.

This number contains no original papers relating to chemistry.

Pharmaceutische Zeitschrift für Russland, No. 15, 1872.

The original papers contained in this number strictly bear only upon pharmacy.

Nos. 16 and 17, 1872.

Testing of Fatty Oils.—H. Ludwig.—This monograph is divided into the following sections:—Colour of the oils; smell and taste of the oils; difference of fluidity and of forming drops of the oils; freezing-point of the oils; capability of drying of the oils; specific gravity—viz., oils the sp. gr. of which is between 0·900 and 0·920; between 0·920 and 0·935; above 0·935; elementary composition of some fatty oils; fatty oils and alcohol; behaviour of fatty oils with polarised light; testing the oils for admixture of resin oil; amount of heat evolved when the oils are mixed with strong sulphuric acid; colouration of fatty oils by concentrated sulphuric acid; action of syrup-like phosphoric acid, $3HO,PO_5$, and oils; behaviour of the oils with nitrous-nitric acid (acidum nitroso-nitricum); fatty oils and nitric acid; peroxide of hydrogen and fatty oils; nitro-sulphuric acid and the fatty oils; chlorine and fatty oils; nitro-hydrochloric acid and fatty oils; caustic soda solution (sp. gr., 1·34) and the oils; dry hydrate of lime and the oils; Bolley's test (solution of carbonate of potassa) and the oils; Seyfried's test (acetate of lead); detection of the oil from *Cruciferæ* by the sulphur they contain; behaviour of some fat oils when heated; action of bichromate of potassa and dilute sulphuric acid upon oils; permanganate of potassa and fatty oils.

No. 18, 1872.

This number only contains original papers relating to pharmacy.

Les Mondes, November 14, 1872.

Project of an Atmospheric Submarine Postal Communication between France and England.—E. Martin.—In this paper the author describes a modified plan, which consists in the use of a narrow tube through which simply microscopic photograms containing the dispatches, produced upon collodiun, are to be transmitted. It appears that this method of operating was first used during the late siege of Paris, and has now been improved upon. The execution of these microscopic photograms can be conducted by day or at night by the aid of the electric light. The tube through which these light pellicules are to be transmitted need only be some few centimetres in diameter. The motion is imparted by compressed air.

Bibliography.—Under this heading attention is called to the following work:—"Recherches sur les Causes et les lois des Mouvements de l'Atmosphère," par J. M. Sanna-Solaro, S.J. (Paris, 1872). This volume, which is highly spoken of by its reviewer, treats on the meteorological phenomena of our atmosphere.

Obituary.—We regret to announce the death of a well-known scientific chemist, M. Poinsot, who for many years has been Assistant Professor at the Conservatoire des Arts et Métiers, and at the Ecole Centrale des Arts et des Manufactures. The deceased worked during many years with the late Professor Payen, and his researches on agricultural chemistry are well and deservedly known.

American Journal of Pharmacy, November, 1872.

In addition to original papers and memoirs strictly relating to pharmaceutical sciences, this number contains the following original papers relating to chemistry:—

New Application of Tube Hydrometers.—Dr. W. H. Pile.—Reproduced in full.

Notes on Benzoin.—A. C. Curtis.—The results of the author's researches may be summarised as follows:—That benzoin contains, in addition to benzoic, a not inconsiderable quantity of cinnamic acid, which can be obtained in free state by boiling the resin with double its bulk of lime, in forty times its own weight of water, for fifteen minutes, filtering, cooling, acidulating strongly with hydrochloric acid, washing the precipitate, and re-crystallising from water acidulated with HCl. The benzoic acid is best obtained from the resin by sublimation, and is in that way procured free from cinnamic acid. Some benzoin contains about one-fourth of impurities, and therefore its pharmaceutical preparations are deficient in strength unless an allowance be made for the impurities.

PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3014. S. H. Johnson, F.C.S., Stratford, Essex, "Improvements in the method of, and apparatus for, separating the soluble constituents of substances from the insoluble constituents."—Petition recorded October 12, 1872.

3202. W. Thompson, Wandsworth Road, Surrey, "Improvements in the manufacture of white-lead, and apparatus therefor."—Petition recorded October 29, 1872.

3250. P. Forbes, Houndsditch, London, "Improvements in means or apparatus for the preservation of substances for food."

3252. E. Withy, and W. Gibson, West Hartlepool, Durham, "Improvements in mixing, charging, and smelting iron ores."

3261. J. A. Wanklyn, Harrington Street, Hampstead Road, Middlesex, "Improvements in the production of oxygen gas."—Petitions recorded November 2, 1872.

3273. J. B. Spence, Manchester, "Improvements in obtaining anthracene, and in apparatus connected therewith."—A communication from J. C. F. Cheever, New York, U.S.A.—Petition recorded November 4, 1872.

3292. E. I. W. Parnacott, Leeds, "Improvements in artificial fuel, part of which improvements having reference to the means or apparatus employed in the manufacture of the same."—Petition recorded November 6, 1872.

NOTICES TO PROCEED.

2003. W. Thwaites, Brixton, Surrey, E. Fondeville and G. Bertin, Kentish Town, Middlesex, "Improvements in the preparation of glaze or coating suitable for covering stone, earthenware, plaster, furniture, and other surfaces."

2004. W. Thwaites, Brixton, Surrey, E. Fondeville and G. Bertin, Kentish Town, Middlesex, "Improved composition or admixture for preserving walls from dampness, and for other purposes."—Petitions recorded July 2, 1872.

2020. J. F. Stewart and H. Defty, Middlesbrough, Yorkshire, "Improvements in, and connected with, puddling furnaces."—Petition recorded July 4, 1872.

2033. J. Miller, Aberdeen, N.B., "Improvements in purifying and decolourising hydrocarbons."—Petition recorded July 5, 1872.

2614. B. W. Gerland, Macclesfield, Cheshire, "Improvements in the manufacture of phosphoric acid, phosphatic manures, alkaline and other phosphates."—A communication from H. Albert, and E. Albert, Biebrich, Germany.—Petition recorded September 3, 1872.

2717. W. S. Dixon, Grosvenor Place, Middlesex, "Improvements in the manufacture of plute iron or refined metal."—Petition recorded September 13, 1872.

2988. J. Young, Kelly, Renfrewshire, N.B., "Improvements in treating liquors containing ammoniacal compounds in order to obtain products therefrom."—Petition recorded October 10, 1872.

3008. W. Ferrie, Airdrie, N.B., "Improvements in applying combustible gases obtained from smelting furnaces, or from gas producers for heating puddling and other furnaces, and in apparatus connected therewith."—Petition recorded October 12, 1872.

3094. E. C. Nicholson, Herne Hill, Surrey, "Improvements in the production of colours for dyeing and printing."

3095. A. P. Price, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of substances capable of being employed for the purposes of dyeing and printing."—Petitions recorded October 19, 1872.

PATENTS SEALED.

1466. E. G. Brewer, Chancery Lane, Middlesex, "Improvements in the manufacture of steel, steely iron, and homogeneous metal, and in apparatus therefor."—A communication from F. G. Bazault, and I. J. Roche, Paris.

1469. G. Bedson, Manchester, "Improvements in puddling furnaces."—Dated May 14, 1872.

1521. C. Herveux, Islington, Middlesex, "Improvements in tanning and in apparatus used therefor."—Dated May 18, 1872.

1604. R. Irvine, Leith, N.B., and J. Mackintosh, Buenos Ayres, Argentine Republic, "Improvements in the manufacture of paper stock."—Dated May 27, 1872.

1739. F. G. Morton, Bermondsey, Surrey, "An improvement in utilising tin-plate scraps or clippings, and in separating the tin and iron contained therein."—Dated June 8, 1872.

1876. S. B. Smith, Birmingham, and J. W. Willans, Middlesbrough, "Improvements in the process of, and apparatus for, smelting iron ores and other ores, and re-heating iron and other metals, parts of which improvements may also be applied to other purposes"—Dated June 21, 1872.

2450. F. Lipscombe, Strand, Middlesex, "Improvements in the treatment of noxious vapours, and in apparatus or appliances in connection therewith."—Dated August 16, 1872.

2518. W. Lochhead, Glasgow, N.B., "Improvements in treating asbestos or amianthus, and applying the same to various useful purposes."—Dated August 24, 1872.

2786. P. P. F. Micheá, Jubbulpore, East India, "New substances for dyeing, printing, and tanning, and the process employed for treating one of such substances."—Dated September 20, 1872.

FOREIGN PATENTS.

SWEDEN.

1. W. Riddell, "Improvements in the manufacture of paper pulp, and apparatus for cutting wood."

12. D. Schröder, "Improvements in his mode of obtaining lighting and heating gas from peat or sawdust."

13. T. Foldberg and E. Nielsen, "Improvements in the manufacture of starch."

14. J. E. Sherman, "Improvements in the manufacture of iron and steel."

21. J. Erichsen, "A mode of obtaining paint."

37. H. Gahn, "A compound or mixture called 'amykos.'"

47. A. P. Sjöberg, "Obtaining grease or oil from distilled resin for lubrication."

49. D. A. Lyfe, "Improvements in heating and preparing substances for the manufacture of paper, and in processes for bleaching other materials."

52. A. R. P. Smith and C. W. Granville, "Improvements in obtaining paper-pulp of wood."

64. A. Ohlsen, "Manufacturing press-yeast of beer-yeast."

66. A. Deininger, "A mode of, and apparatus for, preparing sundry plants for paper-making and spinning."

71. L. E. Bowman, "A reverberatory furnace for smelting copper, lead, and nickel."

73. H. R. Fanshawes, "Improvements in the treatment of hides and skins in tanning, and otherwise utilising all portions or pieces thereof, and in the treatment of goods already tanned."

75. C. J. Schmiedte, "An apparatus for the manufacture of concentrated manure of human excrements, or so-called 'super-phosphate of cess-pools.'"

76. H. Searle and C. Eskrett, "A kind of oil-cake."

85. T. E. Petersen, "A salve for preventing the incrustation of steam boilers."

86. B. Tanner, "Improvements in the manufacture of superphosphate of lime."

87. A. G. Southby, "Improvements in operations for drying down alkaline solutions of extractive matter obtained in preparing vegetable fibrous materials for use in the manufacture of paper, and in recovering alkali therefrom for re-employment."

90. F. W. Colls, H. Atkinson, J. J. Michael, and T. W. Knight, "Improvements in preparing pulp from wood and other fibrous substances for making paper, papier mâché, and other analogous manufactures."

94. W. Riddell, "A process and apparatus for disintegrating, softening, washing, and bleaching wood, straw, esparto grass, and other vegetable fibres, and for extracting resin, silica, or other substances therefrom."

97. T. C. Hinde, "Improvements in the manufacture of iron and steel."

98. J. A. Zee, "Improvements in obtaining paper-pulp of wood."

106. O. Beckman, "Obtaining so-called 'malt coffee.'"

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THE CHEMICAL NEWS.

VOL. XXVI. No. 679.

NEW FACTS ELUCIDATING OUR KNOWLEDGE OF THE THEORY OF FERMENTS, PROPERLY SO-CALLED.

By Dr. L. PASTEUR.

I HAVE for a considerable time considered fermentation (properly so-called) to be a chemical phenomenon correlative with physiological actions of a peculiar nature, and I had previously proved that the ferments which excite fermentation are not dead albumenoid matters, but living organisms. I have induced the fermentation of sugar, lactic and tartaric acid, and glycerine, in fact all kinds of fermentation, in mediums exclusively mineral, thus affording incontestable evidence that the decomposition of fermentable matter is correlative with the life of the ferment, so that it is one of its essential foods. For instance, under the conditions just alluded to it is impossible that there should be, in the constitution of the ferments which are generated, a single atom of carbon which is not derived from matter suitable for fermentation. The chemical phenomena of fermentation are distinguished from many others, and more particularly from those of the acts of life in its ordinary sense, by the fact of the decomposition of a far greater weight of fermentable matter than that of the ferment in action. I have long thought that this particular character is related to that of nutrition without contact of free oxygen. Ferments might therefore be considered as living beings, but endowed with a life, *sui generis*, in the sense that they possess the property of accomplishing all acts of life, procreation inclusive, without in any way requiring atmospheric oxygen. The mind here recurs to those singular infusoria which induce butyric or tartaric fermentations, or certain putrefactions, and which not only live and multiply without oxygen, but are even killed and cease to induce fermentation as soon as oxygen gas is dissolved in the liquid, or soft semi-solid substance, in which they live. By direct experiments made with beer-yeast I have found that, if the life of that very small cellular plant were partly dependent upon oxygen, it would, according to the proportion of intensity of that influence, partly lose its character of ferment; that is to say, the weight of yeast formed under these conditions during the decomposition of the sugar would gradually become greater, and approximate to the weight of decomposed sugar when gradually the life of the yeast plants continues to linger on in the presence of increasing quantities of free oxygen. Guided by these facts, I have been led to consider fermentation as a *conditio sine qua non* of the manifestation of life, when that life exists beyond the direct combustion due to free oxygen gas. As a consequence of this theory, we may consider that every being, every organ, every cell, which lives, or can continue to live, for any length of time, either without any atmospheric oxygen at all, or only in a very limited proportion, for its whole existence, is to be regarded as possessing the character of a ferment in reference to the substance which supplies it either wholly or in conjunction with heat. This substance must of necessity be oxygenated or carbonated, since, as already stated, it yields food to the ferment; because all *fermentescible* substances contain these two elementary substances. Let us take, for instance, a saccharine liquid, suitable for the food of ferments, and place it in a vessel in such a manner that we can put into that liquid any special organised production, so that no other organisms can afterwards, unknown to the experimenter, betake themselves spontaneously—that is to say, germs suspended and floating about in the air—into the same liquid. Upon that liquid let us place a trace of pure *mycoderma vini*, and we shall find that after a few days the surface of the liquid is covered with mycoderma, in the shape of a thin, but continuous film, and that the development of the mycoderma under these conditions gives rise to absorption of atmospheric oxygen, which is replaced by carbonic acid, while, on the other hand, no alcohol is formed.* Let us repeat this experiment, under precisely the same conditions, and, when the film of mycoderma is fully formed, let the vessel be so shaken about that the film is as much as possible submerged, because the fatty matter adhering to it prevents its becoming readily moistened and totally submerged; and we shall find that on the next day, or even in a few hours, if the vessel and contents are kept at from 25° to 30°, small gas bubbles are evolved from the bottom of the vessel, proving that the alcoholic fermentation has set in. This continues for some days, although weakly, and it is easy to obtain from the liquid perceptible quantities of alcohol. Microscopic examination of the submerged cells of the mycoderma proves that they are not reproduced, but that they become swollen and the interior structure of their plasma greatly altered. If the fermentation ceases, it can be again set in action by causing the freshly-formed film of mycoderma to be submerged afresh in the saccharine liquid.

The interpretation of these facts is not difficult, because we see in these comparative experiments cells which, at the desire of the operator, become ferments or cease to be so. The question arises, What is the difference in the condition of existence of the cells of the *mycoderma vini* in each of these cases? In the first, the life of the plant on the surface of the liquid continues and is kept up by the atmospheric oxygen; while, in the other case, that life continues and is sustained beyond, and without the influence of oxygen, or at least under the influence of a very small quantity only of that gas, because that which may have become dissolved in the fluid is retained by the living cells left on the surface of the liquid. That life is not extinct in the submerged cells is proved by microscopic research, as well as by the fact that the cells induce fermentation. I will not speak here of a case in which the sporules placed upon the surface of the liquid produce real beer-yeast, because I shall have another opportunity of returning to that subject. We see, in this double experiment, on the one hand, the life or multiplication of cells, with absorption and assimilation of free oxygen, and formation of a corresponding volume of carbonic acid; and, on the other, the continuation of the life of a portion of these cells when submerged, and without the aid of oxygen gas, but with the correlative appearance of alcoholic fermentation, that is to say, a continued evolution of carbonic acid gas and production of alcohol.

It is rather curious that similar experiments made by me succeed with ordinary mouldiness; the *Penicillium glaucum*, for instance, which lives in contact with free oxygen, and takes up as much of it as it can consume for the purpose of accomplishing all the acts of its nutrition and rapid development, does not produce alcohol at all, but as soon as this cryptogamic plant is deprived of oxygen, and submerged under a liquid fit for the production of the phenomena of fermentation, its character changes entirely, and this change is accompanied by the production of alcohol and carbonic acid precisely in proportion to the duration of the acts of nutrition of the plant under its new condition of existence.

Beer-yeast, that type of ferments, and the other organised ferments which I have discovered, may therefore be con-

* I have previously said that the mycoderma has two modes of living (existence)—that is to say, that it is either mouldiness or ferment, according to circumstances—and that the beer-yeast of so-called bottom fermentation is no other body than mycoderma, which is converted into that yeast when deprived of the contact of atmospheric oxygen. I ought also to observe that the phenomena which characterise this conversion are rather complicated, but that I shall soon be enabled to give all the particulars of it. I am bound to make this observation here because I speak above of *mycoderma vini* in terms somewhat different from those here used.

sidered as plants or animals which differ from lower living organisms in that the former are endowed with the faculty of living and multiplying, beyond the contact of air, regularly and for a prolonged period of time. I have reason to believe that the mystery of fermentation is explained and elucidated by the results just alluded to.

By organised ferments we mean such organisms as are capable of continuing their existence, and of multiplying without the necessity of free oxygen for the purpose of burning and setting in action the materials of their nutrition; organisms, in other words, which can directly assimilate oxygenated matters capable of supplying heat by their decomposition, such, for instance, as sugar. Viewed in this light, fermentation appears to us as a peculiar case of a very general phenomenon; and we might say that all living beings are ferments in certain conditions of their lives, because there do not exist any in which momentarily the action of free oxygen could not be suspended. Let any living being be killed by asphyxia, by section of nerves, &c., or let any organ in such a being be deprived of life, the consequence is that since physical and chemical life cannot be instantaneously extinguished it will continue, and if that happens with privation of free oxygen (interior or exterior), then the being, the organ, the cells, will forcibly take the heat they require for their new acts of nutrition or for change in their tissues from the materials by which they are surrounded. From that moment they will decompose those materials, and we shall see the proper character of fermentation appear if the quantity of heat developed corresponds to the decomposition of a weight of fermentable matter perceptibly larger than the weight of materials set in action by the living being, by the organ, or by the cell.

The following facts appear to me to be the logical deduction of these principles. Dr. Bérard has told us (in a published memoir) that when fruit is placed in air or in oxygen gas in an enclosed space, a certain volume of that gas disappears, and an almost equally large bulk of carbonic acid gas is substituted for it. When the fruit is placed in a similar manner in carbonic acid or any other inert gas, a very perceptible quantity of carbonic acid gas is still formed, as if, says Dr. Bérard, it were developed by a kind of fermentation.

The following is, to my view, the interpretation of these facts. When fruit or any organ whatsoever is separated from the plant or from the animal of which it formed a part, life is not at once extinct in the cells which are component portions of such fruit or part of animal. The ripening of fruit after having been gathered is a palpable proof; if air is present, oxygen intervenes and plays a part in the changes which take place in the interior of the fruit. The heat is derived from the combustion which is the result, and in which the sugar plays a great part; but in that case there is no difference between the nutrition then taking place and that which occurs when the fruit is still upon the tree, and is characterised by living beings by this, that the weight of the materials transformed or set in activity is comparable to that of the materials which serve the purpose of food. It is clear that under such conditions no alcohol nor carbonic acid can be formed, except accidentally, any more than when the *mycoderma vini* lives with a supply of free oxygen.

In these conditions for every volume of carbonic acid produced a nearly equal volume of oxygen is consumed; it is in fact, ordinary respiratory combustion. Let the fruit be placed in an atmosphere of carbonic acid, and it will be found that life continues by taking from the decomposition of the sugar the heat it requires for its sustenance. The cells are then in the condition of those of ferment which live beyond free oxygen, as is the case with the cells of *mycoderma vini* when submerged. Almost as soon as fruit is placed in carbonic acid, alcohol is formed along with that gas, and although the quantity of it be small it is quite apparent; for in my experiments. 24 plums gathered from the tree and placed in carbonic acid gas yielded after a few days 6·5 grms of absolute alcohol, while the fruit had not undergone any change, but was quite sound. A corresponding quantity of sugar had, of course, disappeared. 24 plums of the same sort, left in contact with air, had become soft watery, and very sweet. Grapes, melons, and all fruits containing acids behave in the same way. A rhubarb leaf placed in an atmosphere of carbonic acid gas gives off, after 48 hours, a somewhat vinous smell, while the leaf apparently is not at all altered, and it yields, on distillation, small quantities of alcohol. I am certain that when the operations are carefully conducted, no beer yeast nor any other ferment is formed. It is only in rare and exceptional cases that ferment cells can penetrate into the interior of fruit. Grapes deserve particular attention in this respect. Everyone may have observed that during the time of wine-making the juice of the freshly pressed grapes, and even the fruit itself, when taken from the tubs, taste and smell quite differently from grapes eaten from the stalks. It is thus with grapes kept in carbonic acid gas for some time. On being taken out of that gas, they have precisely the same taste and smell as fruit in the press-tub. This is due to the fact that during the wine-making the grapes are suddenly plunged into an atmosphere of carbonic acid.

I have no doubt the study of the phenomena here alluded to, when applied practically to the gathering of grapes, might become useful for the art of wine-making, and I should not be surprised if, by preserving bunches of ripe grapes in an atmosphere of carbonic acid, it were possible to prepare specialities of wine and brandy which would be highly valued in commerce.

I have not had time to study these points of view in animal organs. It is probable that the phenomena may differ from those exhibited by vegetable cells. Very likely the equations of all these fermentations of a new species will differ not only with every kind of cell, be it animal or vegetable, but in each instance, according to their proper nature. The few experiments made by me upon organs of the animal kingdom are too incomplete to be spoken of here, but I believe that—reasoning from the results obtained—a new view will be for physiology and pathology, and I hope that much light will be thrown on the phenomena of putrefaction and gangrene, while the production of putrid gases beyond the reach of organised ferments will receive an equally sound explanation as the formation of alcohol and carbonic acid beyond the presence of cells of alcoholic ferment.—*Comptes Rendus.*

ON OXY-AMMONIAS AND PHOSPHINE BASES.

By SAMUEL E. PHILLIPS.

The recent and valuable researches of Hofmann on the oxidation of phosphine bases necessitate a re-examination of the many disjointed facts which confuse the literature of chemical science. The isolated aspect of Hofmann is one of numerical ingenuity, but that the radicals of nitric acid or phosphinic acid consist of NO_2, or PO_2, are points of the very slenderest hypothesis.

In writing a paper on the amides some 20 years ago, we contended that they were *intermediate* between the basic ammoniums on one side and acid ammoniums on the other, and that the latter rose in the electro-series, and were more definitely acid in proportion as the radical replacements of H were more negative or acidifying.

It was then contended that "acid + ammonia − 2HO = the amide;" while "2 of acid + ammonia − 4HO = the aminic acid." Since then a fertile extension of this generic law has opened up in the kindred formula, "alcohol + ammonia − 2HO = a basic amine," of which the sugar-salt of M. Bouchardat is a recent illustration; "glucose + ammonia − 2HO = glucosamine" (like the glucosaniline of M. Schiff). The platinum salt is—

$$(C_{12}H_{11}O_{10})H_3NCl+PtCl_2$$

The obstinacy of Berzelius in admitting that Cl might replace and function to some extent the positive or basic H has been felt in my own case, in regard to the more exceptional replacement of H by O. Meanwhile, the facts typified in hydroxylamine have slowly accumulated until the crowning and brilliant researches of Hofmann have prompted this review.

Before proceeding to minutiæ, it may be well to offer an open breast and pay still further homage to the new school of thought in the admission that hydroxyl (HO_2) may, peradventure, in some weak and inconspicuous instances, function as a radical and replace one H.

The botanist wisely discriminates between normal types and monsters, and it would be well if a like logical care were evinced in chemical philosophy.

The fixation of 2 or more atoms of O in organic radicals is typical of the negative hydrocarbons, and is far more exceptional in those which have a larger proportion of H.

The hydrocarbon of acetic acid is normally $(C_4H_3O_2)$, and is exceptionally (C_4H_3); just as that of alcohol is normally (C_4H_5), and exceptionally $(C_4H_5O_2)$.

Admitting that $(C_4H_5O_2)$ or (EO_2) and $(C_2H_3O_2)$ or (MeO_2) may function as radicals, and replace one H, it may be possible that in a more exceptional case (HO_2) may do so likewise. This cautious admission, however, should in no way justify the curious and frequent use made of hydroxyl, and much less of potassoxyl (KO_2). We stay not here to consider the paucity of evidence, or the intense unlikelihood of such dispositions of atomic force, nor can we enter upon the tempting subject of polyamines or condensed ammonias. The outset or first stage of that action is, however, of so common a character, and enters so largely into ordinary chemistry, that we cannot pass it over without a few remarks.

Ammonia ordinarily exists in two forms, each of which has it hydride or non-combining characteristic, and each has its combining function as a base or an acid. The hydride forms are typically $H_3N=17$ and $H_3\overline{N}$, or $(H_6N_2)=34$, both ordinarily 2 vols. One is ammonia, and the other may be called atmonia. I say typically, because atmonia in its simplest form is as yet hypothetical, though its forms abound in every manual of the science.

A confused assemblage of modern types subsist by which atmonium forms consist of 8H elements, or their equivalents, and the erroneous assumption is, that the hydride combines with two atoms of acid, as contra-distinguished from a simple ammonia which combines with one only.

The simple truth is the opposite of all this; for whereas ammonium $=4H$ to one N, so atmonium typically consists of 7H to two N; and as both affect the same volume, so both unite similarly with *one* atom of acid to form compounds of similar types, and similar general properties. This confusion is well exemplified in a paper on the platinum compounds by Professor Odling (Chemical News, vol. xxi., p. 289). Comparing ethylamine with ethylenamine, he tabulates the distinction thus:—

Monamine Type.		Diamine Type.	
KCl	$(4)N,Cl$	$BaCl_2$	$8N_2'',Cl_2$
KHO ..	$(4)N,HO$	$Ba(HO)_2$.. ..	$8N_2''(HO)_2$

The *true* chloride of ethylenamine would be $(7)N_2Cl$, strictly comparable with the ethylamine chloride. The above bichloride (?) the so-called "hydrochlorate," is the chlorhydrate of ethylenamine, $(7)N_2Cl+HCl$; like the—

Hydrate of ammonium, $(4)NO+HO$
Hydrate of ethylenamine, $(7)N_2O+HO$,
The crystallised hydrate, $(7)N_2O+3HO$

Whether the barium chloride is better notated as $BaCl_2$, and the hydrate $Ba(HO_2)_2$, or as I should prefer it, BaCl and $BaO+HO$, involves a wide question of diatomic philosophy which I am anxious to avoid in this connection; hence my numerical or typical representations.

The Professor says, "The double ammonia (ethylenamine) combines with 2 atoms of hydrochloric acid to form the definite hydrochlorate." Precisely; but the same necessity equally exists with the simple ammonia! In either case 1 atom of acid forms the chloride, and 2 atoms yield the chlorhydrate, and similarly with the oxide and hydrate.

Nobody contends that the condensed or di-acids combine with 2 atoms of base, or that the di-alcohol, or di-glucoses replace 2 of H; and yet they are directly comparable with the double ammonias or *diamines*.

For every chloroplatinate of ammonium, $(4)NCl+PtCl_2$, we have a corresponding platinate of atmonium—

$$(7)N_2Cl+PtCl_2.$$

Urea is a di-carbamide, yet we know that the acetate is normally $(7)N_2O+AcO$, or $(CO)_2H_5N_2O+(C_4H_3O_2)O$.

Similarly M. Gentz gives us di-xylyl guanidine, $(C_{16}H_9)CyH_3N_2$, and the platinate salt—

$$(C_{16}H_9)CyH_4N_2Cl+PtCl_2.$$

M. Cahours and Gal give chlorides of both ammonium and atmonium.

Chloride of gold arsine	E_3AuAs,Cl
,, ,, palladium arsine ..	E_3PaAs,Cl
,, ,, platinum ,, ..	E_6PtAs_2,Cl
	$Me_3PtAsCl$.

Hoping that these preliminary remarks may have cleared the way, we proceed to a brief glance at the oxy-ammonias; and first among these stand the hydroxylamines of M. Lossen.

Hydroxylamine	$H_2(HO_2)N$
Di-ethylamine..	$E_2(HO_2)N$
Di-benzylamine	$(C_4H_5O_2)_2(HO_2)N$
Tri-benzylamine	$(C_{14}H_5O_4)(C_{14}H_5O_4)N$
Hydroxamylene ammonia ..	$H_3(C_{10}H_{11}O_2)NCl$
By abstraction of 2HO	$H_3(C_{10}H_9)NCl$
Hydroxethylen tri-ethylamine	$E_3(C_4H_5O_2)NCl$
Chloroplatinate ,, ,,	,, ,, $NCl+PtCl_2$
Chloroaurate	,, ,, $NCl+AuCl_3$
Hydrate	,, ,, $NO+HO$
Homologue of choline	
Hydroxylamine urea	$(CO)_2H_3(HO_2)N_2$
Chlorhydrate ,, ...	$(CO)_2H_4(HO_2)N_2Cl$
Semi-chlorhydrate of hydroxylamine	$H_5(HO_2)_2N_2Cl$
Sesqui-chlorhydrate of hydroxylamine	$H_7(HO_2)_3N_3Cl+HCl$

These are culled from various memoirs given during the last few years; and the names, types, and ideas involved, are certainly grotesque. But it is not a little remarkable that they all, without one exception, conform to the principles of an older and simple chemistry, which is now seen adequate to comprehend the most exceptional cases of modern research.

As to the homologue of choline, the type is perfectly *identical* with the glycol-ethylamine produced by M. Wurtz, who found it to be identical with the *choline* of liver, or the *neurine* of brain.

Next come the antimony and arsenic bases, and their oxyaminic acids, of which I have by me just now only the slender enumeration of Lowig.

The methyl-arsine, Me_3As, would seem strictly analogued by Hofmann's Me_3P. Of the ammoniacal forms Me_4As, and their oxides and chlorides, and corresponding salts, we say nothing here as they are so simple and well known. The Me_3As affects 2 vols. like the corresponding Me_3N, or H_3N, &c.

Lowig gives methyl, ethyl, and amyl forms of these bases, and lays stress on the peculiarity (?) that whereas the tetra forms (ammonium) combine with 1 O.Cl.S, &c., the tri forms (ammonia) combine with 2 atoms. Of course they do, to the production of the combining ammonium type; and methinks a fuller development would exhibit hydroxylamine varieties. Speaking of the oxide he says, "It behaves like an inorganic base,

and with acids gives soluble crystallisable salts," $Me_3OAsO+2HO$, &c.

The antimony bases are doubtless strictly parallel, but a confusion subsists with kakodylic acid, and probably hydroxymaline varieties. That (H_2N) is a radical, replacing 1 H, is generally admitted; but whether it combines with elements atom for atom is not so clear. The corresponding E_2P, or Me_2As, do so combine, and give us oxides, chlorides, or sulphides! The oxide of kakodyl, Me_2As, "is a real base, and combines with acids to form crystallisable salts." Kakodylic acid is best regarded as an oxaminic acid, and, like the corresponding phosphinic acid, "it resists the action of the most powerful reagents."

The sulpho form is equally definite with sulpho bases, and there is a corresponding chloro type—

$$Me_2O_2AsO+HO$$
$$Me_2O_2AsS+HS$$
$$Me_2O_2AsCl+HCl, \&c.$$

Lastly come the phosphine series of Professor Hofmann. Chemists will very highly appreciate his refined and beautiful improvements in the production of phosphine bases, but these products are too simple and well-known to occupy us in this connection. At the outset of this comparison, however, a great difficulty subsists in the italicised statement that the oxidised tri-methyl phosphine "is no longer capable of forming saline compounds;" whereas we have seen that the corresponding arsine "behaves like an organic base." Whether viewed as a simple oxy-ammonium, or as a possible hydroxylamine variety, in either case we think it ought to dedouble in weakly saltic forms, and thus destroy the numerical symmetry of the Hofmann series.

The great step involved in the easy production of the mono- and di-phosphines is stated with much force and interest. The formula of production, so well put, is, however, further simplified by omitting unnecessary diatomic doubling.

Primary Phosphines.

(E = Ethyl or other radical.)

$$E_1+H_4P_1+ZnO = EH_3P_1 \text{ and } Zn_1 \text{ and } HO.$$

Secondary Phosphines.

$$2E_1 + H_4P_1 + 2ZnO = E_2H_2P_1 \text{ and } 2ZnO \text{ and } 2HO.$$

Tertiary Phosphines.

$$3(EO+HO) + H_4P_1 - 6HO = E_3HP_1 \text{ and } 6HO.$$

Quaternary Phosphines.

$$4(EO+HO) + H_4P_1 - 8HO = E_4P_1 \text{ and } 8HO.$$

The first of these is described with much interest, and the chloride, iodide, sulphide, sulphate, and chloroplatinate are spoken of—

$$MeH_3PCl$$
$$MeH_3PCl+PtCl_2$$
$$MeH_3PO+SO_3, \&c.$$

The second evinces a still greater tendency to oxidation than the first; however, it easily unites with acids to the production of crystallisable salts, just as we have seen with Lowig's arsine analogues. The chloroplatinate is $E_2H_2PCl+PtCl_2$. But the main interest attaches to the oxidation of these bases; I give a comparative list:—

Hofmann.		Phillips.
H_3P fixes 4O and = HO, HO, HO } PO	=	$O_4P,O+3HO$ (Phosphoric acid.)
EH_2P ,, 3O ,, = CH_3, HO, HO } PO	=	$MeO_3PO+2HO$ (Methyl-phosphinic acid.)
E_2HP ,, 2O ,, = CH_3, CH_3, HO } PO	=	Me_2O_2PO+HO (Dimethyl-phosphinic acid.)
E_3P ,, 1O ,, = CH_3, CH_3, CH_3 } PO	=	$Me_3OPO+HO_3$ (Tri-methyl-phosphinic oxide.)
To this I add E_4P fixes ½O	=	Me_4PO+HO.

The stabillty of the first is striking when compared with the isomeric and weakly "methyl-phosphorous acid (phosphide of methyl), $MeO,2HO+PO_3$; but how may we analyse its typical character with data so vague as the following. The lead salt is given "$(CH_3)PtPO_3$, or perhaps more correctly $(CH_3)_2PtP_2O_6$. Analysis showed the barium salt to be $C_2H_6BaP_2O_6=(CH_3)_2H_2BaP_2O_6$!" I believe these two salts to be—

Lead salt, $2PbO+MeO_3P,O$

Barium salt, $2BaO+MeO_3P,O$.

The second is evidently monobasic; it is well and clearly defined, and corresponds with the analogues described by Lowig:—

Silver dimethyl-phosphinate =	$Me_2O_2PO+AgO$
Potassium dimethyl-arseniate	Me_2O_2PS+KS, &c.

The third body we have referred to as anomalous, and we unhesitatingly predict for it a weak saltic dedoublement; and if so, the hydrate would complete my series.

Hofmann speaks of the typical representative of his series as "tribasic ortho-phosphoric acid"; whence it follows, if the notation has any meaning at all, that the ordinary acid is PO, with 3 atoms of hydroxyl base, that the fourth is the same with 3 atoms of methyl base, and intermediately with the others; but how ill this accords with the facts is well seen by my representation of the facts.

The typical acid is a pure oxy-acid, and combines with 3HO, 3KO, or 3MeO, &c.

The first derivative is a "methyl-phosphoric acid," which combines with 2 atoms of HO, KO, MeO, &c. The third would be a tri-methyl acid were it not too basylous; replace the 3 atoms of Me by a more negative hydrocarbon, and it would be weakly acid, or with 1 H it is distinctly basic, while with 1 O it is equivocally intermediate.

In so far as my types represent *these facts* they are independent of any theory, and *absolutely true*.

As modern chemists will persist in the prolific multiplication of hybrid details with an impetuosity which disdains the higher study of the unity and simplicity of law, I feel bound to give a reluctant glance at a few of the modern memoirs in connection herewith.

M. Michaelis (Chemical News, vol. xxv., p. 57), gives some varied phosphine chlorides:—

$$Cl_4P,Cl$$
$$Br_2O_2P,Cl$$
$$Cl_2O_2P,Cl$$
$$Br_2Cl_2P,Cl$$
$$S_2BrClP,Cl$$
$$(C_4H_5S_2)Cl_2P$$
$$(C_4H_5S_2)_3P$$
$$(C_4H_5O_2)_3OP,S.$$

As S is a very unusual constituent of ammonia, I give a few from M. Merz and W. Weith (Chemical News, vol. xxiii., p. 299).

Aniline	$(C_{12}H_5)HHN$
Thio-aniline	$(125)SHN$
The chloro-platinate ..	$(125)SH_2NCl+PtCl_2$
The sulphate	$(125(SH_2NO+SO_3$
The oxalate	$(125)SH_2NO=C_2O_3$, &c.

Schutzenberger (Chemical News, vol. xxvi., p. 26) gives some alcoholic platinum chlorides—

$$(C_4H_5O_2)_3PtPCl+PtCl$$
$$(452)_3Pt_2H_5PN_2,Cl$$
$$(452)_3Pt_2H_5PN_2Cl+HCl$$
$$(452)_6PtP_2,Cl$$

And similar series with $(C_2H_3O_2)$.

Also "phospho-platinous chloride	$Cl_3PtPCl+PtCl$
,, platinic ,,	$Cl_6PtP_2Cl+PtCl$
,, platinous acid	$(HO_2)_3PtP_2Cl+PtCl$
,, platinic ,,	$(HO_2)_6PtP_2Cl+PtCl$

M. Chevrier in the *Journal of the Chemical Society* gives some further variations :—

$$(C_{14}H_5)H_5PtN_2Cl$$
$$(145)H_5PtN_2Cl+PtCl$$
$$(145)H_5PtN_2O+NO_5$$
$$(145)H_8PtN_3Cl+PtCl$$
$$(145)H_8PtN_3I+PtI$$
$$(C_4H_5)H_5PtN_2Cl$$
$$(45)_2H_9Pt_2N_4,Cl.$$

M. Saillard (Chemical News, vol. xxvi., p. 23)—

$$(C_{14}H_7)(C_4H_5O_2)_3H_2PtPN,Cl+PtCl,$$
$$(147)(452)_3H_2PbPNO+HO, \&c.$$

It is curious to observe that the index plainly points to a future resolution into one large group of "ammonia combinations" of all the nitric and phosphoric acids, and their analogues.

Between these ammonia acids on one side, and the ammonia bases on the other, I see no line of separation or distinction whatever; and if we represent by X, oxygen or other negative constituent, and by M, hydrogen or the more basic metals, then it will be found that the same laws of type and constitution equally subsist throughout the — or + regions.

Just as X_2N is inic or combining, and X_3N non-combining, while X_4N is eminently inic, so the same laws subsist with (M_2N), M_3N, and (M_4N).

On the one side we have NO_2 and NO_4, the radicals of nitrous and nitric acid, and on the other the perfectly analogous substitutions with (H_2N) and (H_4N), while $(NH_2)H$ is hydridic or non-combining.

Just as the nitrous combinations are weak and slender as compared with the nitric, so the basic forms of (H_2N), are still more slender and inconspicuous.

As no amount of hydrid or unstable variety seems to satisfy the cravings of modern chemistry for new and abnormal forms of combination, so this view may be acceptable as indicating a new field in condensed nitric, phosphoric, and other acids.

We have nitric acid O_4NO+HO; why not di-nitric O_7N_2O+HO, or tri-nitric $O_{10}N_3O+HO$ analogous to the corresponding di-amine and tri-amine bases.?

Since writing the above, and looking round for phospho varieties, we observe in addition to the chloro-sulphide ammonias of M. Chevrier, with their alcoholic derivatives, the phospho-amides of M. Schiff and Dr. Gladstone.

The resolution of the former is plain and easy beyond measure; the latter are under investigation, and are full of interest and promise. They involve a new feature of amide (H_2N), ammoniacal substitution, and undoubtedly contain the very condensed phosphoric acids anticipated in the above paper.

ELECTRICITY OF PLANTS.

In the *Sitzungsberichte* of the Bavarian Academy, Dr. Ranke has recently described some researches on this subject.

Our knowledge of animal electricity is in great part due to Du Bois Reymond, who showed that, while the life of tissues continues, electric currents pass through the organs according to definite laws, and in correspondence with the various phenomena of life. It was reasonable to expect that in plant organisms something analogous would be found to occur. The vital phenomena in the two cases are not qualitatively different; but, in the case of animal life, exchange of material stands out more prominently, and in the case of plant life, assimilation.

The electric current observed by Du Bois Reymond between a wound and the uninjured coating of a muscle is not to be understood as a true animal electricity. It arises from the heterogeneous nature of the wound-surface acting with greater electromotive force on the electrode applied to it.

Buff and Heidenhain observed a current on similar treatment of plants, and they rightly attribute it to the chemical and electromotive difference between the sap flowing in the wound and the water with which the uninjured surface is moistened for the other electrode. It has no connection with the process of vegetation.

Dr. Ranke, experimenting in this way, observed the wound-surface to be negative with regard to the uninjured surface, and he names the currents thus produced false currents.

Between uninjured parts of the longitudinal surface, or between parts not become very heterogeneous (through soiling with sap or otherwise) Buff observed no regular current, and Dr. Ranke's experiments confirm this. They do not, however, confirm Buff's other observation, that no regular electromotive action was to be observed between the internal parts of plants.

As to this latter point, it was necessary, in the mode of observation, to guard against the development of false currents from heterogeneities of surface: to see that the two electrodes were not unequally soiled by the escaping sap. For example, more of the fluid flows from a cross section than from a longitudinal section; hence, an electrode being applied to each, the action on one would be greater than that on the other. Another source of possible error lay in chemical heterogeneity, as, *e.g.*, if one electrode were applied to a part of the tissue having an alkaline reaction, the other to a part having an acid reaction, in which case currents (similar to the false) would be obtained. To guard against this, only those plants were taken in which no trace of a difference of reaction was observable. The petioles of *Rheum undulatum* proved serviceable in this respect.

Another point of importance was the fibrous structure. As in the electricity of animals, the electromotive action was observed where the fibres did not lie parallel to the longitudinal axis.

The pieces experimented with, then, were cylindrical pieces from the petioles of the *Rheum undulatum*, their longitudinal axis corresponding with the axis of the petiole; and they were terminated by two cross sections perpendicular to this axis. They were 2 to 3 c.m. length, and 0·5 to 1·5 c.m. diameter of section. The apparatus for measuring the currents was similar to that used by Du Bois Reymond in his experiments.

If a piece of the kind described was taken, and one electrode applied to the cross section, the other to any point of the uncut epidermis, the false current appeared, the cross section being negative to the other surface. If now the outer surface of the piece was removed by cutting parallel to the axis, and the electrodes were applied, one to the cross section, the other to the surface laid bare as described, there was in every case a current observed, the direction of which was from the surface of cross section to the other (through the wire); hence the reverse of the false current, and of the currents in muscles and nerves. This is the true plant current, the expression of the real electricity of plants; Dr. Ranke styles it the strong current, using in this and in other cases a terminology corresponding to that of Du Bois Reymond. By a further cutting of the piece, either perpendicular or parallel to the axis, the current at first sometimes increases, but it gradually becomes weaker as the process is continued.

Du Bois Reymond named an imaginary cross section in the centre of a cylindrical piece of animal tissue the equator, and a line through the middle of the cross section the axis. When he applied the electrodes to two points of the cross section, which were symmetrical to the axis, or to two points of the longitudinal section, which were symmetrical to the equator, there was no current. But if the points were not thus symmetrical, there was a current; in the one case, the point more distant from the axis being positive to the nearer; in the other, the point nearer to the equator being positive to the more distant. In plants, something quite analogous is observed, the dissection of the currents, however (named like those of

Du Bois Reymond, the weak currents), being reversed. Thus, in the case of plants, where two unsymmetrical points are taken in the cross section, that which is further from the axis is negative to that which is nearer. And of two unsymmetrical points on the longitudinal section, that which is nearer to the equator is negative to that which is more distant.

Further, in pieces cut of a rhombic form, currents were observed analogous to those Du Bois Reymond observed in similarly cut muscles, from the acute to the obtuse angles; but in the plants the direction was reversed.

Another point of correspondence between animal and plant electricity is that the currents only appear during the life of the tissue. The reaction of tissues which show animal electricity is always more or less alkaline, or neutral. After separation of the tissue from the living body, an acid reaction is gradually produced, and when this has taken place the electromotive action disappears. The living tissue of plants, on the other hand, is generally more or less acid, and in the death of the tissue an alkaline reaction is produced, and then, also, the electromotive action is extinguished.

Dr. Ranke experimented with a large number of plants besides *Rheum*, and found in each case the same laws of electromotive action to hold good where the fibres were arranged parallel.

Experiments were also made with pieces in which the fibres were not parallel, as in the case of certain roots; and the normal electric currents were met with if the shape of the root did not depart very much from the cylindrical, was not very conical. If, for the point of application of an electrode on the longitudinal section, a part of the root was chosen at which the tissue branched off, this acted as a cross section, and the current might be reversed. The same remark applies to stems.

Dr. Ranke observes, in the conclusion of his paper, that the similarity which has been established between animal and plant electricity warrants us in applying to the latter, with certain modifications, Du Bois Reymond's molecular hypothesis of animal electricity. We may suppose the interior of electromotive parts of plants filled with small peripolar molecules embedded in a conducting substance, the axes of these (joining the poles of each molecule) being parallel to the axis of that part of the plant containing them. The theory of animal electromotors supposes each of the molecules to have two negative polar zones, and one positive equatorial. The law of plant electricity requires, on the other hand, for each of the molecules, two positive polar zones and one negative equatorial.

A. B. M.

MINERALOGY.

A COURSE of six lectures on the above subject is in course of delivery to working men only at the Geological Museum on Monday evenings, by W. W. Smyth, F.R.S., Lecturer on Mining and Mineralogy at the Royal School of Mines. The first lecture was delivered on Monday, Nov. 11th, and dealt principally with definite geometrical forms assumed by inorganic substances.

These, he said, are extremely multifarious and varied; but, as they are intimately connected with the internal structure of the substances, and with their optical and other properties, it becomes very necessary to make ourselves acquainted with the laws governing these forms if we would rightly understand the substances themselves. Some observations on these forms were made by the Ancients, but they never appear to have been led to generalise on the matter. An objection to the more general study of this subject is often urged in that perfect and regular crystals could only be seen and studied in large collections and in museums; but the lecturer showed that, even in this science, materials for common observation were at hand if people would only look for them. He admitted, at the same time, however, that there is a great advantage to be derived from first studying those regular and perfect forms before advancing to less regular and less distinct ones. As an example of the common occurrence of crystals, he instanced those large white finger-like masses to be seen in the stone employed in many of our London bridges, which are often mistaken for fossils, but which are really crystals of the kind of felspar known as "orthoclase." Again, in examining a piece of common granite carefully, besides crystals like the above on a smaller scale, other crystals of a darker substance may also be seen, together with some thin leaf-like pieces of a third substance having a strong lustre. These are crystals of the materials of which granite is formed, viz., felspar, quartz, and mica. In a piece of crystalline marble may be seen also numerous bright little crystals lying in all manner of positions. In all the above cases, the individual crystals are not fully developed, because, owing to their lying so close together, they have more or less mutually interfered with each other.

If the crystals have been formed under favourable conditions, they will always assume a definite form, from whatever part of the world they are obtained. Thus, a crystal of quartz or rock crystal was shown to assume the form of a hexagonal prism, terminated by a hexagonal pyramid; a crystal of beryl to have a hexagonal prismatic form, but terminated by plane faces. And as each individual substance always assumed the same form, with certain definite limits and modifications, a knowledge of these forms must necessarily be a great help towards determining the nature of any inorganic substance. The lecturer illustrated this by referring to a fine quartz crystal on the table, brought by a Cornish miner from Brazil under the impression that it was a large diamond. The diamond always crystallises in the octahedron and allied forms. Sometimes, as in the case of carbonate of lime, the modifications of the fundamental form are very numerous, in that substance amounting to twelve hundred, but all within definite geometrical limits.

There are several possible ways of describing a crystal, *e.g.*, the position of its faces might be referred to the walls and ceiling of a room, or of some figure surrounding them, or they might be referred to certain imaginary lines or axes drawn within them. The latter is the mode now generally adopted, and forms which are in external appearance quite distinct are capable of being grouped together by means of their axes. Thus the hexagonal prism and hexagonal pyramid agree in having a hexagonal middle section, and they both belong to a system characterised by having one upright axis and three equal horizontal axes intersecting at equal angles. By means of axes placed in certain positions, the rhombohedron, and the scalenohedron (bounded by twelve scalene triangles) might be referred to the same group. Similarly with the group to which the octahedron belongs (and of which that form is taken as the basis) in which the axes are all equal. If we imagine a triangular pyramid erected on each face of the octahedron, we shall get a figure with twenty-four faces, technically called the triakisoctahedron. The cube is derived from the octahedron by imagining a plane in each angle of that figure parallel to the two axes not belonging to that angle.

According to this method of grouping together crystals according to their internal axes, six groups or systems are distinguished:—

(*a*). *Cubical System.*—To which the cube and octahedron belong. Has three equal axes intersecting at right angles, one regarded as vertical, and the other two as horizontal.

(*b*). *Hexagonal or Rhombohedral System.*—Has one vertical and three horizontal axes, the latter making equal angles with each other and being equal among themselves, but shorter or longer than the vertical.

(*c*). *Pyramidal or Tetragonal System.*—Has axes like the cubical system, with the exception that its vertical axis varies in length, being sometimes longer and sometimes shorter than the horizontal ones.

(*d*). *Rhombic or Prismatic System.*—All its axes are unequal, though, like (*a*) and (*b*), intersecting at right angles.

(*e*). *Oblique System.*—Characterised by three unequal axes, two in the same plane at right angles to each other, the third oblique to that plane.

(*f*). *Doubly Oblique System.*—In this all the axes are of unequal length, and make unequal angles with each other.

Under one or other of these groups of forms may be classed, not only all the crystallised substances found in nature, but also those artificial crystals produced in the laboratory of the chemist.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 21st, 1872.

Dr. Frankland, F.R.S., &c., President, in the Chair.

The minutes of the previous meeting having been read and confirmed, the names of Messrs. Alfred Payne, George Combe Stewart, Robert Routledge, and George B. Beilby were read for the first time; and for the third time, Messrs. Arthur Willis and George Symington Grieve Paton, who were balloted for and duly elected.

The first paper, "*On the Standardising of Acids*," by W. N. Hartley, F.C.S., was read by the Secretary. Instead of the sodium carbonate usually employed for this purpose, the author prepares a solution of pure sodium hydrate from a block of metallic sodium cut from a bar of that metal, and which is weighed in a capsule made from two test-tubes having their lips cut off and inverted one within the other. The sodium is dissolved in alcohol and then diluted with water; as the strength of the solution thus obtained is known, it may be at once employed for standardising the acid.

Dr. Frankland, in thanking the author in the name of the Society, remarked that everyone who had worked with standard solutions of acids had experienced the difficulty there was when employing sodic carbonate, owing to the carbonic anhydride preventing that sharp recognition of the point of neutralisation which was obtained when a solution of caustic alkali was used.

The next communication, "*On Anthraflavic Acid*," was read by the author, Mr. W. H. Perkin, F.R.S., &c. After alluding to his former paper on the same subject, in which he had expressed his opinion that anthraflavic acid was an isomer of alizarine, a view since confirmed by Auerbach, he stated that, when anthraflavic acid is strongly heated, it yields a golden yellow sublimate having the properties and composition of the original substance, and that the product obtained on fusing anthraflavic acid with alkalies, and which Schunck supposed to be alizarine, produces very different shades with alum mordants from those obtained with the latter colouring matter.

On heating the acid with acetic anhydride to 160°, a new compound, *diacetyl-anthraflavic acid*—

$$C_{14}H_6O_2\begin{cases}(C_2H_3O)O\\(C_2H_3O)O\end{cases}$$

is obtained, which crystallises in very pale yellow plates, not unlike benzoic acid in shape, and which melt at about 228°. The corresponding *diacetyl-alizarine*, prepared in a similar manner from alizarine, crystallises in flat needles or plates, which melt at about 160°, and are more soluble in alcohol and glacial acetic acid than diacetyl-anthraflavic acid. Anthraflavic acid, treated with benzoylic chloride, yields *dibenzoyl-anthraflavic acid*—

$$C_{14}H_6O_2\begin{cases}C_7H_5O)O\\C_7H_5O)O\end{cases}$$

a crystalline substance, of a pale yellow colour, which fuses at 275°. It would appear from the researches of Liebermann and Auerbach, that not only does anthraflavic acid occur as a by-product in the manufacture of artificial alizarine, but another substance, *monoxyanthraquinone*, $C_{14}H_7O,HOO$, differing from it in being readily soluble in baryta water.

The President said he was sure the Members would agree with him in thanking their Secretary for the additional information he had given them on the subject of anthraflavic acid, although he questioned how far we were justified in calling the compound an acid, as, when the basic hydrogen is replaced by acetyl or benzoyl, it yields compounds which do not possess the properties of anhydrides, as they should do if it were a true acid.

Mr. Perkin replied that he regarded the hydrogen as being more of an alcoholic nature, and that he had merely retained the name of anthraflavic acid originally given to it by Dr. Schunck.

Dr. Debus asked whether the author could suggest any rational formula for the substance, or any combination of atoms which would show the nature of the substance.

Dr. Armstrong observed that it was probable that the sulpho-acids obtained from anthracene for the preparation of alizarine were a mixture of isomeric acids, from one of which the anthraflavic acid was derived. Naphthalene and phenol, as is well known, yield isomeric sulpho acids.

Mr. Perkin replied that the sulpho acids employed were certainly a mixture—both mono and disulpho acids were present, and probably also isomeric forms of the latter; but as yet he had not any process by which the anthraflavic acid could be directly prepared.

In reply to some observations by Dr. Debus on the internal movement of atoms which takes place when isomeric bodies change one into the other, Dr. Armstrong remarked that, if this were the case, the change of place amongst the carbon atoms must be most extraordinary in some instances. For example, in the butylic series the alcohol—

$$\begin{cases}CH_3\\CH_2\\CH_2\\CH_2OH\end{cases}$$

when converted into the corresponding butylamine, and then into the nitrate, yields the secondary alcohol—

$$\begin{cases}CH(CH_3)_2\\CH_2OH\end{cases}$$

and from this, again, by a similar process, we obtain the tertiary alcohol—

$$C\begin{cases}CH_3\\CH_3\\CH_3\\OH\end{cases}$$

These changes, however, pointed to a method of great importance by which it was probable we might generate many new compounds. Each of these butylic alcohols had a lower boiling-point than that from which it was derived. Might not the amylic alcohols, if treated in a similar manner, yield the whole series?

Dr. Debus said that, if an organic compound went through a series of changes, it was assumed that the end product contained the same nucleus as that from which we originally started. Although this was generally true, it was not by any means a universal proposition, for there was a strong body of evidence to show that the nucleus sometimes underwent change.

The President said, the supposition that the atoms do not move in a compound must be received with caution, although it was true that some organic compounds might be treated with the most powerful reagents, and still retain their original form. The amylic alcohol, which causes a deviation of the plane of polarised light, was of this class; even boiling with sulphuric acid and acid potassic chro-

mate did not cause it to lose this property, which was also possessed by all its compounds, so that we may assume it does not change, as its effect on light remains the same.

Dr. ARMSTRONG remarked that the sulpho acid produced by treating it with sulphuric acid, and yielding the gummy barium salt, had no effect on polarised light.

Professor WILLIAMSON said that, in the present state of our knowledge, certain facts seem to establish a change in the nucleus which had hitherto been deemed impossible; and he agreed with Dr. Debus that, although there are numerous instances in which the nucleus is not affected, we now and then come across one in which a change appeared to take place, and the number of these was rapidly increasing.

Dr. DEBUS said that, when we consider inorganic compounds, we find great mobility amongst the atoms; but this was not the case with organic substances, in which the carbon atoms seemed to be so locked together, as it were, that there was no freedom of motion amongst them, and this property was extended to the other elements, such as chlorine and hydrogen, with which they happened to be in combination. For instance, sodium chloride gives a precipitate of argentic chloride with silver nitrate, but carbon chloride dissolved in alcohol does not give argentic chloride with silver nitrate, neither do the alcoholic chlorides, like chloride of ethyl. Under certain circumstances, however, such as increase of temperature, the force which held the atoms together became weakened, so that they became able to move with greater freedom and arrange themselves in new positions, forming new combinations.

Dr. WILLIAMSON desired to call the attention of the Members to a case of this which was well known to them all, that of bitter almond oil, a well defined and undoubted aldehyde, which, under the influence of alcoholic potash, split up into benzylic alcohol and benzoic acid. We are too prone to forget these well-established cases of change of position, and allow them to escape our notice. The fixity of carbon in organic compounds was unparalleled amongst inorganic compounds, and in this respect quite exceptional.

Dr. FRANKLAND said that, in these internal movements of the atoms, the great matter of surprise was that the carbon atoms should change their places, and not that the other elements should do so.

The meeting then adjourned until Thursday, December 5th, when there will be two papers by Professor C. Rammelsberg, "On the Reducing Power of Phosphorous and Hypophosphorous Acids and their Salts," and "On Hypophosphites; also a paper "On New Analyses of some Mineral Arsenites and Phosphates," by Professor A. H. Church.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 29th, 1872.

EDWARD SCHUNCK, Ph.D., F.R.S., Vice-President, in the Chair.

DR. R. ANGUS SMITH, F.R.S., described a remarkable fog which he saw in Iceland. It appeared to rise from a small lake and from the sea at about the same time, when it rolled from both places and the two streams met in the town of Reykjavik. It had the appearance of dust, and was called dust by some persons there at first sight. This arose from the great size of the particles of which it was composed. They were believed to be from $\frac{1}{300}$th to $\frac{1}{500}$th of an inch in diameter. They did not show any signs of being vesicular, but through a small magnifier looked like transparent concrete globules of water. They were continually tending downwards, and their place was supplied by others that rolled over.

Ordinary Meeting, November 12th, 1872.

J.P. JOULE, D.C.L., LL.D., F.R.S., &c., President, in the Chair.

Charles Anthony Burghardt, Ph.D., and Henry Arthur Smith, F.C.S., were elected Ordinary Members of the Society.

"*An Account of some Experiments on the Melting-Point of Paraffin*," by B. STEWART, F.R.S.

The following experiments were made with the view of ascertaining—

(1). Whether the melting-point of different specimens of paraffin is the same.

(2). Whether that of the same specimen remains the same.

The method of observation adopted in these experiments was as follows. The thermometer had its stem fitted into the cork of a colourless glass flask so that when the flask was corked the bulb was in the centre of the flask, the extremity of the mercurial column appearing during the experiment slightly above the cork. The flask was kept heated to a point slightly below that of the melting-point of paraffin. The bulb of the thermometer was then dipped for a few seconds into some melted paraffin a few degrees above its melting point, and while covered with a fluid coating of paraffin was replaced in the centre of the flask. The flask being only a very little colder than the bulb, the cooling was then very slow.

The instrument was placed so that the reflected image of the bar of a window was seen distinctly in the mercury of the bulb through the liquid paraffin. One observer carefully scrutinised this reflected image by a lens, while another watched the downward progress of the column of mercury in the stem of the thermometer. As soon as the observer scrutinising the image observed a want of definition produced by incipient freezing, he noted the circumstance to his colleague watching the column, and thus the exact reading at which freezing began was ascertained. It was found easily possible to ascertain this point to one-tenth of a degree Centigrade. Four or five separate observations were generally taken, before each of which the thermometer was re-dipped into the melted paraffin.

In case of any change taking place in the zero of the thermometer while the experiments were in progress, the instrument was tried in melting ice before each experiment. The thermometer employed was a standard, constructed at Owens College, No. 3.

The coating of paraffin surrounding the bulb was sometimes kept from one experiment to another, being always carefully dried after the bulb was plunged in melting ice, and sometimes it was removed, but this circumstance did not appear to affect the results.

It was soon seen that different specimens of paraffin had very different melting-points, so that the research was directed to the second question, namely, whether the same specimen retains the same melting-point, after being frequently melted and solidified.

The following is a record of the various experiments made;—

1872.		
Feb. 29 ..	Paraffin melted at 45·05.	
Mar. 6 ..	,, ,,	(thermometer not observed).
,, 13 ..	,, ,,	at 44·90.
,, 21 ..	,, ,,	(thermometer not observed).
,, 26 ..	,, ,,	at 44·90
April 11 ..	,, ,,	(thermometer not observed).
,, 19 ..	,, ,,	(thermometer not observed).
,, 26 ..	,, ,,	at 45·00.
May 3 ..	,, ,,	(thermometer not observed).
,, 10 ..	,, ,,	,, ,, ,,
,, 16 ..	,, ,,	at 45·00.
,, 23 ..	,, ,,	(thermometer not observed).
June 1 ..	,, ,,	,, ,, ,,
,, 6 ..	,, ,,	,, ,, ,,
,, 13 ..	,, ,,	at 44·90.

The paraffin was melted without an observation of the thermometer at the following dates—June 19, 27; July 3, 19, 25; Aug. 1, 9, 16, 22, 31; Sept. 6, 14, 21, 27; Oct. 8, 17.

Observations with the thermometer were then resumed with the following results:—

Oct. 24	..	Paraffin melted	at	44·60.
,, 31	..	,,	,,	(thermometer not observed).
Nov. 7	..	,,	,,	at 44·70.
,, 11	..	,,	,,	at 44·75.

The experiments now described have been made chiefly by Mr. F. Kingdon, assistant in the Physical Laboratory of Owens College. The most probable conclusion to be deduced from them appears to be that the melting-point of this specimen of paraffin has become somewhat lowered since the experiments began.

It is proposed to continue these experiments for some time longer; but in the meantime it has been thought desirable to describe the method of research, as this may be of interest to observers of melting-points.

CORRESPONDENCE.

MANUFACTURE OF SOAP.

To the Editor of the Chemical News.

Sir,—Kindly allow me space for a few remarks with reference to the paper on "The Analysis of Soaps" (Chemical News, vol. xxvi., p. 207), by Mr. J. Jean.

This gentleman makes a great mistake in classing resin amongst the fraudulent adulterations of soaps. Its employment in certain kinds is, beyond cavil, clearly insisted upon by the greatest number of consumers of the article. They will have soap so made, and no other. Enquiry of any one merely acquainted with the routine of a Soapery will suffice to prove this. Moreover, as I have been intimately associated with the practical details of the manufacture for twenty years past, I am enabled to add that this requirement as regards resin is simply a matter of fact. The demand for pale or yellow soaps—an indispensable feature of which is that they must contain from one-fourth to about one-third of resin—has existed for about a century past; and the call for these sorts, so far from diminishing, continues steadily on the increase.

In conclusion, allow me to add that about two years ago I solved the somewhat knotty problem as to the determination of the amount of resin in admixture with fatty matters in such soaps. This I can always effect in about one hour. Almost all the leading soap-manufacturers in England have been for some time in possession of the method, which I have only disclosed under a secret arrangement.—I am, &c.,

Alfred G. Anderson,
Professor of Practical Chemistry in Queen's College, Birmingham.

146, Ladbroke Grove Road, North Kensington, W.,
November 26, 1872.

ODOURS OF PLANTS.

To the Editor of the Chemical News.

Sir,—I much appreciate Mr. Robert Mallet's remarks in your issue of the 15th inst. upon my previous brief communication concerning the "Utility of Odours to Plants in relation to Radiant Heat," but cannot quite understand whether the views to which he courteously refers as coinciding with my own were expressed only verbally or in manuscript to Professor Tyndall, or were published in any of the scientific journals. If the latter were the case, perhaps Mr. Mallet will kindly intimate in which of those periodicals they appeared.

Permit me also to observe that, although the question of quantity or "how much" is, as Mr. Mallet has remarked, an important one in most scientific speculations, still inability strictly to answer it does not always invalidate, or materially affect, our conclusions. In the case of odorous vapours, it must, too, be remembered that we are contemplating matter in, to us, an *imponderable* form, and that, therefore, any inferences relative to mere quantity must be extremely problematical.

I would, moreover, remind Mr. Mallet that, so far from the air in Professor Tyndall's experimental tubes having been "saturated in an odorous vapour," it was merely allowed to pass once over bibulous paper wetted with the different perfumes referred to in the lecture, and consequently the amount of the vapour taken up by it must, we may fairly conclude, have been as "infinitesimally small and unweighable as that which is sufficient to diffuse the perfume of the flower or fruit."

Perhaps the comparative loss of odour, mentioned by Mr. Mallet, in "the orange orchards of the South," may be attributable to the greater dryness of the air in those latitudes, and the consequent want of the great carrier of vegetable odours—aqueous vapour.

If, however, the odour emitted be absolutely less in this and similar cases, the "heat jacketting" effects, on account of a higher atmospheric temperature, may be less needed by the plants in those regions.

Begging to thank you for the insertion of my preceding very imperfect observations,—I am, &c.,

W. H. Olley.

Stoke Newington, November 23, 1872.

MISCELLANEOUS.

The Chemical Prælectorship at Cambridge.—We are informed that Mr. J. Alfred Wanklyn has applied for this appointment. In the interest of Science we should be glad to see Mr. Wanklyn holding a chemical appointment.

London and General Water Purifying Company.—During the recent absence of H.R.H. the Prince of Wales from Sandringham, the London and General Water Purifying Company received orders to apply their system of filtration throughout the establishment, which they completed on Saturday last. It may therefore be considered that the danger arising from the former impurity of the water is now removed.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, November 18, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral sciences:—

Shape to be Given to the Standard Meters which the International Committee for Weights and Measures is about to get Constructed.—M. Tresca.—The author explains at length the reasons why the Committee determined to give to the standard meters a shape somewhat resembling an X; this shape exhibits by the smallest bulk of metal the greatest resistance, which exceeds 30 kilos. to the square millimetre; the lines indicating the divisions of the meter are to be engraved between the branches of the X.

Researches on the Natural Production of Nitrates and Nitrites; Application of Mineral Manure to Horticulture.—J. Jeannel.—Reserved for full translation.

Researches on Liquid Carbonic Acid.—L. Cailletet.—After briefly referring to Thilorier's researches on the liquefied carbonic acid gas (which boils at −78° at atmospheric pressure), the author describes his apparatus for experimenting with this fluid, which is colourless, very mobile, and a non-conductor of electricity; it neither dissolves common salt, sulphate of soda, chloride of calcium, nor carbonate of potassa, which is converted into bicarbonate insoluble in the fluid; carbonate of lime, either in the form of Iceland-spar or chalk, is not dissolved by this fluid, even under a pressure of 130 atmospheres (1950 lbs. to the square inch). Sulphur and phosphorus are insoluble in liquefied carbonic acid, but iodine is somewhat soluble therein; water scarcely dissolves the fluid, but ether and petroleum oil dissolve it readily, and sulphide of carbon dissolves it to some extent. Fatty oils are somewhat soluble in the liquefied carbonic acid, but stearine and paraffin are insoluble therein.

New Native Silver Amalgam from Kongsberg, Norway.—F. Pisani.—Reference is first made to the hitherto-known, and mineralogically described, native amalgams of silver. The two varieties of the mineral investigated by the author are crystalline; one has a dull silver-white colour, the other a light brass-yellow. The first variety was found to contain, in 100 parts, 95·26 of silver, and 4·74 of mercury; the other, 94·94 of silver, and 5·06 of mercury. On further investigation of a sample of native crystalline silver from the same locality, the author found that it also contains mercury, but in larger quantity, viz., 13·7 per cent, and 86·3 per cent of silver; formula, Ag_6Hg.

Action of Sulphurous Acid on Recently-Precipitated Insoluble Sulphurets.—A. Guérout.—This essay treats at length on the action which sulphurous acid exerts upon the recently-precipitated metallic sulphurets. It appears that whereas some of these are quite insoluble in this acid (viz., the sulphurets of copper, silver, gold, platinum, and mercury), others are dissolved, but this is attended by the formation of hyposulphite, and is the result of the three following successive reactions:—(1) Formation of a sulphite and of sulphuretted hydrogen; (2) decomposition of the sulphuretted hydrogen and the sulphurous acid, with formation of sulphur and water; (3) combination of the nascent sulphur with the sulphite.

Tooth of the Elephas Primigenius Found by M. Pinard in Alaska, North America.—A. Gaudry.—The locality where the tooth was found is situated at 59° N. lat. and 156° 41′ W. long. from Paris. The contents of this paper bear mainly upon palæontology; the analysis of the tooth proved it to contain, in 100 parts—Mineral matter, 64·95; organic matter, 23·97; water, 11·98. The author observes that this tooth (although a genuine fossil) contains nearly as much organic matter as that contained in the teeth of living elephants; usually the quantity of organic matter met with in such fossil remains or in bones does not exceed 3 per cent.

This number again contains memoirs on fermentation. Among the papers not relating to chemistry we call attention to an important memoir:—

Theory of the Production of Animal Heat.—Dr. Bouillard.

The American Journal of Science and Arts, November, 1872.

This number contains no original papers relating to chemistry.

La Revue Scientifique de la France et de l'Etranger, November 25, 1872.

This number contains no papers relating to chemistry, but we call attention to an exhaustive memoir:—

The Cattle Plague, Luesbovina.—M. Bouley.—This essay contains important information on the antiquity, origin, and propagation of the disease, and also on the best means of preventing its increase, as well as its complete extinction.

Bibliography.—Under this heading attention is called to the following works just published:—"Etudes sur le Vin, ses Maladies, Causes qui les Provoquent, Procédés Nouveaux pour les Conserver et le Vieillir," par M. L. Pasteur; Paris: Savy, 1872. "Elément de Statistique," par L. Poinsot, Membre de l'Institut et du Bureau des Longitudes; onzième édition, précedée d'une notice sur L. Poinsot, par J. Bertrand, Membre de l'Institut; 1 vol., avec planches; Paris: Gauthiers-Villars, 1873. "Cours de Physique Mathématique," par M. Emile Mathieu, Professeur à la Faculté des Sciences de Besançon; Paris: Gauthiers-Villars, 1872.

Polytechnisches Journal von Dr. E. M. Dingler, second number for October, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Preparation of Cyanide of Mercury.—A. Lielegg.—The author describes, and illustrates with a woodcut, an improved method of preparing cyanide of mercury, by passing the vapours of anhydrous hydrocyanic acid into water in which finely-divided oxide of mercury is suspended.

Behaviour of some Metals with a Solution of Ferricyanide of Potassium.—Professor Böttger.—The metals palladium, thallium, magnesium, and arsenicum possess, according to the author's researches, the property of reducing, or converting to a lower degree of oxidation, certain saline solutions; among these are ferricyanide of potassium, converted into ferrocyanide, perchloride of iron into protochloride, persulphate of iron into protosulphate. If, into a solution of 5 decigrms. of ferricyanide of potassium in 100 c.c. of distilled water, a piece of palladium-foil is placed for ten minutes, daylight being excluded, it will be found, on testing this solution with a peroxide salt of iron, that the ferricyanide has been converted into ferrocyanide. Platinum, zinc, cadmium, aluminium, copper, indium, lead, cobalt, silver, mercury, tin, bismuth, antimony, tellurium, gold, manganese, and iron, have no action on the solution.

Analysis of the Commercial Red Phosphorus.—Drs. R. Fresenius and E. Luck.—It appears that this substance contains on an average a total percentage of 92·63 of red or amorphous phosphorus, 0·56 of yellow phosphorus, 1·308 of phosphorous acid, 0·88 of phosphoric acid, and 4·622 of water. The phosphorus is oxidised by nitric acid, and the phosphoric acid estimated as pyrophosphate of magnesia; the yellow phosphorus is eliminated from the mass by means of sulphide of carbon.

Journal de Pharmacie et de Chimie, November, 1872.

In addition to several papers relating to pharmaceutical science, this number contains the following original paper bearing upon chemistry:—

Explosive Property of a Mixture of Nitrate of Potassa and Acetate of Soda.—M. Violette.—It appears that the author, while heating a mixture of nitrate of potassa and acetate of soda in a small glass flask, was seriously injured by a sudden and violent explosion of the substances he operated upon. This accident gave rise to further investigation, the result of which is that a mixture of 100 parts of nitrate of potassa and 60 of acetate of soda, when heated and fused at about 300°, do not explode, and may even, after cooling, be pulverised and granulated; but if the salts are heated to 350°, or ignited by means of red-hot iron, a violent explosion instantly takes place. When either the nitrate or acetate is in excess of the quantity mentioned, the mixture only burns as dry wood would do.

Les Mondes, November 21, 1872.

This number does not contain any original matter relating to chemistry.

Bulletin de la Société Chimique de Paris (double number), October 1 and 15, 1872.

This number contains the following original papers and memoirs:—

Compounds of Yttrium and Erbium.—P. T. Clève and C. Hoeglund.—This second instalment of an exhaustive memoir is elucidated by a large number of complex formulæ; it treats mainly on the salts and double salts of the metals. Most of the salts of yttrium and erbium contain the same quantity of water of crystallisation as the corresponding salts of magnesium and zinc; the sulphates are isomorph with the sulphate of cadmium, and the platinocyanides crystallise in the same form as the platinocyanide of magnesium. The authors have not isolated the metals (erbium and yttrium), but from many of their combinations they appear to be triatomic. No analytical method of separating the metals just named from each other has been found by the authors, but it is easy to deduct from a mixture of known weight of their oxides the atomic weight by the following formula:—

$$ErO = 240{\cdot}19\frac{MO - 75{\cdot}7}{MO}$$

The atomic weight of the oxides obtained from the following minerals has been found by Clève to be—

	Atomic Weight.	Per cent of Oxide of Erbium.
Fergusonite from Ytterby	90·54	39·37
Nohlite from Kongelf	84·80	25·77
Euxenite from Arendal	90·62	38·97
Yttrotantalite from Karafuet ..	80·08	13·14

Solvent Property of Glycerin.—M. Klever.—100 parts of glycerin dissolve the following substances in the following proportions:—Carbonate of soda, 98; borate of soda (borax), 60; arseniate of potassa, 50; arseniate of soda, 50; chloride of zinc, 50; tannic acid, 50; urea, 50; alum, 40; iodide of potassium, 40; iodide of zinc, 40; sulphate of zinc, 35; sulphate of atropine, 33; cyanide of potassium, 32; sulphate of copper, 30; cyanide of mercury, 27; bromide of potassium, 25; sulphate of protoxide of iron, 25; sulphate of strychnia, 22·5; acetate of morphia, 20; acetate of lead, 20; arsenious acid, 20; arsenic acid, 20; carbonate of ammonia, 20; carbonate of soda, 20; chlorate of soda, 20; chloride of ammonium, 20; chlorhydrate of morphia, 20; lactate of protoxide of iron, 16; oxalic acid, 15; acetate of copper, 10; benzoic acid, 10; boracic acid, 10; chloride of barium, 10; bicarbonate of soda, 8; tartrate of iron, 8; bichloride of mercury, 7·5; sulphate of cinchonine, 6·7; tartar emetic, 5·5; polysulphuret of calcium, 5; nitrate of strychnia, 4; chlorate of potassa, 3·5; atropine, 3; brucine, 2·25; iodine, 1·9; veratria, 1; cinchonine, 0·5; quinine, 0·5; morphine, 0·45; tannate of quinine, 0·25; strychnia, 0·25; phosphorus, 0·2; sulphur, 0·1.

Quantitative Estimation of Phenol.—M. Schaedler.—The substance in which the quantity of phenol is to be ascertained is treated with concentrated sulphuric acid, which combines with the phenol (present in any sample of commercial phenol), while the impurities are carbonised by the acid. The resulting phenol-sulphuric acid is converted into a baryta salt, in which the quantity of phenol-sulphate of baryta present is estimated by the conversion of that salt into sulphate of baryta. The operation is described as follows:—2 or 3 grms. of the phenol to be tested are mixed with an equal weight of pure and strong sulphuric acid, and the mixture heated to from 50° to 60° for some

time; the mixture is next diluted with water, neutralised with carbonate of baryta, decanted, filtered, washed, and the filtrate precipitated with dilute sulphuric acid; the ensuing precipitate of sulphate of baryta is collected upon a filter, washed, dried, ignited, and weighed. 233 parts of sulphate of baryta correspond to 188 parts of phenol; the quantity by weight of sulphate of baryta found has to be multiplied the *rapport* $\frac{188}{233}$, which is equal to 0·8069.

There is added to this number a comprehensive price-list of the well-known firm of Billaut, Billandot, and Co., 24, Rue Sorbonne, Paris, of chemicals and rare chemical compounds, as well as chemical and other apparatus required for scientific research.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, July, 1872.

In addition to two essays relating to chemistry which have been already noticed by us from the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin*, this number contains the continuation of the following memoir:—

On Hypophosphites.—Dr. C. Rammelsberg.—This portion is divided into the following sections:—Reducing action of hypophosphorous and of phosphorous acid; phosphorous acid and silver salts; phosphorous acid and copper salts; hypophosphorous acid and silver salts; hypophosphorous acid and copper salts; hypophosphite of ammonia; composition of fluid hypophosphorous acid.

Composition of the Black Yttrotantalite.—Dr. C. Rammelsberg.—Sp. gr. of this mineral = 5·425; percentical composition of the ignited mineral—Tantalic acid, 49·36; niobic acid, 13·15; tungstic acid, 2·52; stannic acid, 1·19; yttria, 11·03; erbia, 7·16; oxide of cerium, 2·37; lime, 6·47; protoxide of iron, 4·30; protoxide of uranium, 1·72.

Journal für Gasbeleuchtung und Wasserversorgung, No. 19, 1872.

This number contains the following original papers collaterally relating to chemistry:—

Thermostatic Gas-Regulator.—J. Jeannel.—The description, illustrated by woodcut, of an apparatus contrived for the purpose of keeping up a regular and high temperature (above the boiling-point of mercury if desired) for use in scientific research.

Oxygen-Gas Illumination Introduced by Tessié du Motay.—F. Le Blanc.—The first portion of the official report of the author, Chief Inspector of Gas-Works and Gas-Lighting in Paris, to the Conseil Général du Departement de la Seine.

Melanges Physiques et Chimiques Tires du Bulletin de l'Academie Imperiale des Sciences de St. Petersbourg, Vol. viii., 1872.

This number, kindly forwarded to us by Dr. A. Boutlerow, contains the following original essays and papers:—

Trimethyl-Acetic Acid. a New Variety of an Isomer of Valerianic Acid.—Dr. A. Boutlerow.—The introductory part of this lengthy monograph is devoted to the mode of preparation of this acid, only obtainable by a complicated and difficult process of operation. Trimethyl-acetic acid—

$$C\begin{matrix}(CH_3)_3\\CO.HO\end{matrix}$$

is at the ordinary temperature a solid, semi-crystalline, diaphan body, fusing at between 34° and 35°, insoluble in water; the taste of this substance is bitter and pungent, while its smell is similar to that of acetic and valerianic acids, but not so disagreeable as the latter. The baryta salt of this acid has the formula $(C_5H_9O_2)_2Ba+5H_2O$, and is a crystalline body readily soluble in water; it contains 40·41 per cent Ba. The silver salt is anhydrous and crystalline, much resembling benzoic acid when slowly deposited from a hot concentrated aqueous solution; formula of silver salt, $C_5H_9O_2Ag$.

On Trimethyl-Formen-Ethyl, an Isomeric Variety of Hexan.—W. Goriainow.—By causing zinc-ethyl to react upon tertiary iodide of butyl, and purifying the fluid resulting from this reaction, the author has obtained a new hydrocarbon in the shape of a colourless liquid boiling at between 43° to 48°; formula, C_6H_{14}; vapour density—in reference to hydrogen, 43·0; in reference to air, 2·975.

Conversion of Amylen into an Amylic Alcohol by means of Sulphuric Acid.—M. Flavitsky.—After referring to the researches made by Berthelot, Erlenmeyer, and Dr. Boutlerow, relating to this subject, the author describes at length his mode of experimenting, by which amylen, prepared at the chemical works of Dr. Marquart at Bonn by the action of chloride of zinc upon ordinary amylic alcohol, has been converted into an amylic alcohol by the action of sulphuric acid; this alcohol having been converted into a chloride, $C_5H_{11}Cl$, this was found to boil at between 85° and 87°, while, by oxidation, the alcohol yielded aceton.

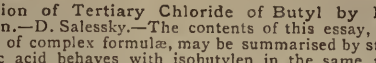
Action of Bromated Bromide of Acetyl upon Zinc-Methyl.—N. Idanow.—In the introduction to this memoir the author mentions a series of researches made on this subject by Terhoukassow. It appears that, by the action of bromated bromide of acetyl upon zinc-methyl, several substances are formed, among which are prominently two alcohols, $C_5H_{12}O$ and $C_6H_{14}O$, but the first-named is the chief product of the reaction. The author continues his researches on this subject, and elucidates the reaction with the following formulæ:—

$$\begin{matrix}CH_2Br\\CO.HO\end{matrix}-O-\quad Br+3CH_3=\begin{matrix}CH_3CH_3\\C(CH_3)_2.HO\end{matrix}$$

$$\begin{matrix}CH_2Br\\CO.HO\end{matrix}-O-HBr+4CH_3=\begin{matrix}CH(CH_3)_3\\C(CH_3)_2.HO\end{matrix}$$

Formation of Tertiary Chloride of Butyl by Means of Isobutylen.—D. Salessky.—The contents of this essay, elucidated by a series of complex formulæ, may be summarised by stating that chlorhydric acid behaves with isobutylen in the same manner as iodhydric acid, the result being the formation of a tertiary chloride of butyl.

New Variety of Hexylen.—N. Tchaïkowsky.—The author records at length the method of preparation of the hexylen alluded to, the formula of which is C_6H_{12}; boiling-point between 68° and 72°; vapour density, in reference to air, 2·908; in reference to hydrogen, 42·0. This hexylen is a fluid substance; constitutional formulæ—



PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3032. J. Hargreaves and T. Robinson, Widnes, Lancashire, "Improvements in treating sulphides, and in obtaining products therefrom."—Petition recorded October 15, 1872.

3067. W. Morgan Brown, Southampton Buildings, London, "An improved composition for preserving wood, metal, stone, brick, paper, textile and felted fabrics, cordage, and cables."—A communication from F. O. Möller, Rue Lavoisier, Paris.—Petition recorded October, 17, 1872.

3300. G. H. C. Hedley, W. Smith, and T. A. Hedley, Salisbury Street, Strand, London, "Improvements in the manufacture and purification of gas, and in the apparatus employed therein and connected therewith."

3308. M. Rae, Uphall, Linlithgow, N.B., "Improvements in the production of artificial fuel and in the machinery employed therein."

3309. H. Deacon, Widnes, Lancashire, "Improvements in the manufacture of bleaching-liquor."—Petitions recorded November 7, 1872.

3318. B. J. B. Mills, Southampton Buildings, Middlesex, "An improved process for cleansing cotton waste and fibrous substances saturated with oils and mixed with *debris* and other matters."—A communication from J. H. Post, New York, U.S.A.

3322. W. Marriott, Huddersfield, "Improvements in the manufacture of salts and oxides of lead, and in apparatus therefor."

3323. A. M. Clark, Chancery Lane, Middlesex, "Improvements in the manufacture of stearic acid."—A communication from E. Deiss, Marseilles, France.—Petitions recorded November 8, 1872.

3335. C. de Sainte Marie, Porte Ste. Marie, France, "An improved process of tanning hides and skins."—Petition recorded November 9, 1872.

3350. H. H. Murdock, Staple Inn, Middlesex, "An improved mode of tanning hides and skins."—A communication from B. Picard, Paris.

3356. J. A. Manning, Inner Temple, London, "Improvements in the treatment of human fœcal matters and in the apparatus or means employed therein."—Petitions recorded November 11, 1872.

3362. L. Banks, Kingston-upon-Hull, "Improvements in the manufacture or composition of fuel."

3371. V. D. de Michele, Delahay Street, Westminster, "Improved process for the manufacture of Portland cement, and in apparatus to be employed therein, and for other purposes."—Petitions recorded November 12, 1872.

3378. F. N. Target, Colyton, Devon, "Improvements in preserving food, and in the means or apparatus employed therein."—Petition recorded November 13, 1872.

3393. G. Clark, Drury Lane, Middlesex, "Improvements in preserving animal and vegetable articles of food, and in vessels, apparatus, and appliances for such preservation."—Petition recorded November 14, 1872.

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

3417. F. Hahn, Berlin, "Improvements in the manufacture of steel and malleable iron, and in furnaces therefor."—Recorded November 16, 1872.

NOTICES TO PROCEED.

2093. J. R. Casbay, Newman Street, Oxford Street, Middlesex, "An improved compound to be applied to the surfaces of wood or metal to preserve the same from corrosion or decay."—Petition recorded July 11, 1872.

2115. J. G. Tongue, Southampton Buildings, London, "Improvements in the production of fertilising materials or manures, and in the means and apparatus employed in the manufacture of the same, partly applicable to other purposes."—A communication from H. A. Hogel, New York, and H. B. Bigelow, New Haven, Conn., U.S.A.

2118. E. C. C. Stanford, Glasgow, N.B., "Improvements in preserving and deodorising sea-weed, and in part applicable for deodorising various animal and vegetable substances."—Petitions recorded July 13, 1872.

2205. H. A. Dufrené, Paris, France, "Improvements in concentrating and evaporating sulphuric acid and other liquids, and in the

apparatus employed therefor."—A communication from M. J. F. R. Faure and J. L. Kessler, Clermont-Ferrand, France.—Petition recorded July 24, 1872.

2510. W. Vincent, Arborfield, Berks, "Improvements in apparatus for manufacturing gas."—Petition recorded August 23, 1872.

2576. G. Spencer, Cannon Street, London, "Improvements in the purification of coal-gas used for illuminating purposes and for mechanical purposes, and in apparatus therefor."—A communication from E. White, New York, U.S.A.—Petition recorded August 30, 1872.

3231. B. F. Weatherdon, Chancery Lane, Middlesex, "Improvements in bleaching textile fabrics and other fibrous materials."—A communication from J. Palliser, R. McDowell, A. Klopsk, and V. Grumel, France.—Petition recorded October 31, 1872.

PATENTS SEALED.

1540. H. Kenyon, H. Kenyon, and J. Swindells, Warrington, Lancashire, "Improvements in the manufacture of chlorine and sulphuric acid."—Dated May 21, 1872.

1583. J. C. Johnson, Newcastle-upon-Tyne, "Improvements in the manufacture of Portland and other cements."—Dated May 23, 1872.

1608. J. H. Selwyn, Gloucester Crescent, Hyde Park, Middlesex, "A new method of treating refractory ores of silver."—Dated May 27, 1872.

1699. J. T. Dann, North Brixton, Surrey, "Improvements in the manufacture of phosphorus."—A communication from G. F. Féron, Rouen, France.—Dated June 5, 1872.

1779. R. McFarlane, Rickmansworth, Herts, "Improvements in treating wood for the production of paper pulp, and in the apparatus employed therefor, parts of which improvements are applicable to the making of steam-tight joints for various purposes."—Dated June 12, 1872.

2277. E. P. H. Vaughan, F.C.S., Chancery Lane, Middlesex, "Improvements in the treatment of phosphates of lime."—A communication from A. Striedter, Paris, France."—Dated July 30, 1872.

2318. J. Henderson, New York, U.S.A., "Improvements in converting cast-iron into steel and wrought-iron, and purifying cast-iron for foundry and other purposes."—Dated August 3, 1872.

2358. T. Warren, Glasgow, N.B., "Improvements in and connected with furnaces employed in the manufacture of glass."—Dated August 8, 1872.

2861. C. W. Siemens, Great George Street, Westminster, "Improvements in the process for the production of iron and steel, and in furnaces or apparatus employed for that purpose."—Dated September 28, 1872.

NOTES AND QUERIES.

Tables of Acids.—Will you kindly let me know the best publication for tables of all the acids diluted, at different strengths, with water?—C. H. H.

Salt.—In reference to salt,—Was the salt mentioned in the Bible NaCl? When Christ said, "Salt is good, but if the salt has lost its savour," &c., what loss or decomposition (if any) is referred to? From the above we should suppose that another salt has been formed. Mr. Maundrell, in the "Valley of Salt, Gebul," says he "broke a piece that had been exposed to the sun and air; though it had the sparkling of salt, yet it had lost its savour; the inner part, which had not been exposed, still retained it." Can you inform me what change takes place, and what brings it about?—S. T. S.

The Reduction of Argentic-Nitrate by Organic Matter.—In January last I placed some crystals of pure argentic nitrate in writing paper, and placed it in a card-box in a cupboard. On opening the paper, which was turned quite black, a few days ago, the $AgNO_3$ was found to have been reduced entirely to the metallic state. It had not fallen to a powder, but was bright and crystalline.—C. T. K.

MEETINGS FOR THE WEEK.

Monday, Dec. 2nd.—Medical, 8.
Tuesday, 3rd.—London Institution, 4.
—— Civil Engineers, 8.
—— Zoological, 8.30.
Wednesday, 4th.—Society of Arts, 8.
—— Geological, 8.
—— Microscopical, 8.
—— Pharmaceutical, 8.
Thursday, 5th.—Royal, 8.30.
—— Chemical, 8. M. C. Rammelsberg, "On the Reducing Power of Phosphorous and Hypophosphorous Acids and their Salts," and "On Hypophosphites." Mr. A. H. Church, "New Analyses of some Mineral Arseniates and Phosphates."
—— Royal Society Club, 6.
—— Philosophical Club, 6.
Friday, 6th.—Geologists' Association, 8.

TO CORRESPONDENTS.

D. C.—Your first question is a geological—not a chemical—one your second and third questions may be answered by reference to a work on Chemistry or Chemical Technology.

J. Boss.—You will find works on the subject at the Patent Office Library, Chancery Lane.

BOOKS RECEIVED.

Fownes' Manual of Chemistry. Edited by Henry Watts, B.A., F.R.S. Eleventh Edition. London: J. and A. Churchill.

Introduction to Inorganic Chemistry. By W. G. Valentin, F.C.S. London: J. and A. Churchill.

The Post-Office Directory of Chemists and Druggists, including Chemical Manufacturers, Wholesale Druggists, Drysalters, and Patent Medicine Vendors, of England, Scotland, and Wales. London: Kelly and Co.

The Chemists and Druggists' Diary and Pharmaceutical Text-Book for 1873. London: Office of Chemist and Druggist, 44A, Cannon Street.

A Practical Treatise on Pure Fertilisers. By Campbell Morfit, M.D., F.C.S. London: Trübner and Co.

What to do in Disinfection, and how to do it. Manchester: Mudie's Disinfecting Company.

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The CLASSES will meet as usual.

The CHEMICAL and TOXICOLOGICAL CLASS on Monday and Thursday evenings at 8 p.m., commencing October 1st.

The LATIN CLASS on Tuesdays and Fridays at 8 p.m., commencing October 2nd.

The MATERIA MEDICA and BOTANICAL CLASS, every Wednesday and Saturday at 8 p.m., commencing October 3rd.

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plates continued to 55° incidence, reached a maximum in the sylvin about 35°, which continued till 55°.

Plates of rock-salt were procured having a thickness of 1 m.m. Taking these as showing the least possible absorption of the heat-rays, Prof. Knoblauch gives a table of the results obtained, and bases on it a statement of the law in its simplest form. It is this :—

(1). With the principal section of the Nicol vertical (*i. e.*, the planes of polarisation and refraction coincident), the coefficients of absorption between 55° and 65° are smaller than between 45° and 55°, a peculiarity which, in substances somewhat absorbent of heat (as most glasses), is masked to an extent dependent on the thickness.

(2). With the principal section horizontal (*i. e.*, with planes of polarisation and refraction crossing), the transmission steadily increases till the angle of incidence becomes equal to the angle of polarisation. And when the plate is inclined beyond the angle of polarisation, decrease takes the place of increase.

(3). With the Nicol at 45°, or with unpolarised rays, the differences first commence, in the case of the rock-salt plates, at an inclination over 55°. Should this appear surprising, when compared with results from the glass and thicker rock-salt, it is to be remembered that the surface of the split lamellæ was much less perfect and favourable to diffusion of the rays than that of the plate-glass or the polished thick plates of rock-salt.

The second influence examined by Prof. Knoblauch (nature of the plate's substance) we defer for the present.

A. B. M.

ON SULPHOPHENIC ACID.*

By A. B. PRESCOTT, M.D.

The limited observations and results which are submitted to the Association in this note, relate to a few points in the preparation, character, and composition of sulphophenic acid and its salts; and, in connection with the report, the interest of the subject has tempted the writer to notice some features of its literature.

The formation of sulphophenic acid is sufficiently simple, being the inevitable result of bringing pure sulphuric and phenic acids in contact; but we have yet to study the most advantageous proportions and conditions for the combination. If the mixture of acids be diluted beyond a certain point, no combination takes place; and when the concentrated acids act upon each other, some portion of each acid remains uncombined under all conditions. Dr. Hager has stated, that however long digestion be continued at 125° F., at least 10 per cent of the sulphuric acid refuses to combine; and he recommends the addition of 120 parts of concentrated sulphuric acid to 100 parts of phenol.

By employment of higher temperatures, I find that the residue of sulphuric acid may be reduced to about 5 per cent of that taken. 50 grms. of sulphuric acid (chemically pure, sp. gr. 1·843), were added to 50 grms. of carbolic acid (Calvert's medicinal, No. 2). The mixture was held at 300° F. for half an hour, cooled gradually with the sand-bath, and then set aside in an open vessel, at about 55° F. The mixture cooled to a thick syrupy liquid, wherein the woolly tufts shortly appeared, and at the expiration of four days, its lower four-fifths consisted of a firmly coherent crystalline mass, while the supernatant liquid was more limpid than concentrated sulphuric acid. Separate determinations of the uncombined sulphuric acid in the supernatant liquid, and of that in the crystalline mass, gave the following results :—

	Barium Sulphate.		Grms. $HO.SO_3$.
Liquid yielded	1·1710	=	0·4924
Crystals ,, ...	5·1325	=	2·1584
Total..			2·6508

* Read before the American Pharmaceutical Association.

As the 50 grms. of concentrated sulphuric acid contained 48·5 grms. of monohydrated acid, it appears that 5¼ per cent of the same escaped combination. Accepting the sulphophenic acid as its typical composition,—

$$HO.C_{12}H_5O.2SO_3$$

(the correctness of which I confirmed in the same sample), it follows that 43·979 grms. of absolute phenic acid entered into union; leaving 6·011 grms., or 12 per cent of the 50 grms. weighed, to be set down as water, impurity, and unappropriated phenol.

Although phenol is not miscible in sulphuric acid before combination, or much more soluble in dilute sulphuric acid than in water, it is miscible in all proportions with concentrated sulphophenic acid, and in less than half its bulk of sulphophenic acid diluted with 4 volumes of water. The addition of much more water precipitates the phenol, which is again dissolved by the addition of a little more sulphophenic acid. Hence, uncombined phenol, however abundant, cannot be separated from sulphophenic acid by water.

The phenol which remains free is less readily removed from the product than the uncombined sulphuric acid; and if the diminution of the former could be secured by a proportionate increase of the latter, without doubt the quantity of sulphuric acid should be increased to this end. But any considerable excess of sulphuric acid prevents the crystallisation of the crude sulphophenic acid; and whether it be due to non-occurrence of crystallisation or not, so far as I have been able to ascertain by the odour and the intensity of qualitative tests, even large stœchiometric excesses of sulphuric acid still leave nearly the same quantity of phenol not appropriated.

The uncombined sulphuric acid is very perfectly and readily removed from the diluted mixture by carbonate of barium, added carefully until the filtrate is precipitated by neither solution of barium nor by sulphuric acid; and this agent will continue to be preferred for this purpose. Oxide or carbonate of lead leaves traces of lead sulphate, and carbonate of lime more than traces of lime sulphate in aqueous solution; but as the sulphophenates are better purified by crystallisation from alcoholic than from aqueous solution, and as the sulphate of lime can be filtered clean from alcohol, the very cheap carbonate of lime may be found applicable in the pharmaceutical manufacture of the salts of sulphophenic acid.

The residual phenol may be removed (1) directly from liquid crude sulphophenic acid by repeated washings with stronger ether. The washing should be continued until the ether, syphoned off, leaves a residue free from the odour of phenol, and, when warmed with nitric acid and then saturated with potassa, is not more than faintly coloured. The water taken up by the ether will carry traces of sulphophenic acid, responding slightly to the latter test. The uncombined phenol is also left behind, (2) by crystallisation of the sulphophenates, preferably from alcoholic solution. When free sulphophenic acid is to be prepared as a final product, its barium salt is decomposed by an equivalent quantity of sulphuric acid, or the calcium salt by oxalic acid or in alcoholic solution by sulphuric acid, or the lead salt by sulphydric acid.

The combination of sulphuric acid with phenol, at any temperature, develops the wine tint which is seen, to a greater or less extent, in sulphophenates; the colour being somewhat deeper if a high temperature has been employed. The application of 300° F. for one half-hour occasions a bright wine colour to be transmitted through a layer 3 inches deep; and the temperature may be kept for some minutes at the boiling-point of phenol (369° F.), with a scarcely perceptible deepening of the tint. This colour is (mainly if not wholly) due to a substance removable from liquid sulphophenic acid by ether washing. In the first washing, the supernatant ether shows a tint of the same depth as the washed acid below; but in subsequent washings the ether colours itself rather less deeply than the tint of the aqueous layer, and I am scarcely able to say that it is practicable to remove every trace of

colour by this means. The evaporation of the decanted ether leaves behind the colour substance a thick, oily liquid of intense blood-red colour, very little odour, fiery taste, strong capillary attraction, colouring paper without the production of a transparent spot, soluble in alcohol, but insoluble in water, very slight acid reaction (probably due to contamination). Heated with soda-lime, it does not generate ammonia; its colour is not changed by chloride of lime, or by heating with corrosive chloride of mercury. The colour removed by ether from carbolic acid which has grown brown in the light is an altogether different substance. I have not succeeded in removing more than traces of colour from crystallised sulphophenates by ether.

Sulphophenates are prepared (1) from crude sulphophenic acid by its direct union with bases or their carbonates; (2) in the same manner from the acid purified only by removal of sulphuric acid, or purified by removal of both sulphuric acid and phenol (ether washing); (3) from crystallised sulphophenates of barium or calcium, or lead, by double decomposition with sulphates or carbonates (calcium) of the bases desired; (4) sulphophenate of zinc by decomposition of the lead-salt with metallic zinc; (5) from sulphophenic acid, first set free from its crystallised salt, and then combined with the bases or their carbonates. By careful and repeated crystallisations, a pure product may be obtained even by the first method, but it is certainly preferable to remove the free sulphuric acid as in the second. For administration, the close removal of the phenol is imperative, as sulphocarbolates are given in doses relatively large.

Sulphophenic acid is soluble in alcohol, insoluble in ether and chloroform. Its salts are sparingly soluble in cold, freely soluble in hot alcohol, insoluble in ether. Pure sulphophenic acid, in aqueous solution of 2 to 5 per cent, promptly coagulates albumen, as likewise do the sulphophenates with acetic acid; but the neutral sulphophenates of alkalies and alkaline earths do not coagulate albumen. To ascertain antiseptic powers, a comparative trial was made by immersing and setting aside pieces of fresh lean meat in the following liquids:—

(*a*). Distilled water.
(*b*). One per cent solution of sulphophenate of sodium.
(*c*). Five per cent ,, ,, ,,
(*d*). Five per cent solution of purified sulphophenic acid.
(*e*). One per cent solution of sulphuric acid.
(*f*). One per cent solution of phenol.

At the expiration of 24 hours, a slight odour of incipient animal decomposition was observable from (*a*), (*b*), and (*c*).

At the end of 36 hours, (*b*), (*c*), and (*a*) evolved offensive odours, that of (*b*) being decidedly most offensive, while (*a*) was somewhat less offensive than (*c*). At this time some sulphate occurred in (*c*), as evinced by barium precipitate, none being found in (*a*). Solution (*b*) was now thrown out.

After 46 hours the putrefaction in (*c*) had advanced little farther than at the previous observation, and was less offensive than that of (*a*), while the filtrate of (*c*) gave a heavier precipitate of barium sulphate than before. A very slight barium precipitate was now obtained from (*d*).

After 60 hours the putrefaction in (*c*) had extended but slightly beyond that previously noted, while the solution gave a still somewhat increased barium precipitate. The barium precipitate from (*d*) was still very slight. Not the slightest fœtor was discoverable in (*d*), (*e*), or (I need hardly state) in (*f*). A 5 per cent solution of sulphophenic acid which had stood open during this time, in the same room, gave no precipitate with chloride of barium. No odour of phenol was detected in (*c*).

It would seem from these observations that sulphophenic acid has a coagulating power and antiseptic effect sufficient, in tolerably concentrated solutions, to preserve animal substance, and that the contact of the coagulated substance effects a very slight separation of sulphuric acid. Also, that sulphophenates do not at all delay the inception of animal decomposition, but do, in some degree, retard the progress of such decomposition, in consequence of which the sulphophenate suffers decomposition (into sulphate, sulphuric acid, and phenol), while no perceptible odour of phenol is evolved.

Neither sulphophenic acid nor its salts suffer decomposition in aqueous solution in the air, and neither suffer more than slight decompositions by long boiling in dilute solutions.

The most delicate test for sulphophenic acid is that likewise the most delicate for phenol,—the production of picric acid and its salts. Strong nitric acid is added and heat applied to form tri-nitrophenic acid instead of the mono- or di-nitrophenic acid, liable to remain if heat be not used. According to Carey Lea, water containing $\frac{1}{100000}$ of tri-nitrophenic acid is distinctly yellow, and when only $\frac{1}{80000}$, the tint is perceptible in a stratum 1 inch deep. The delicacy of the test is much increased by adding sufficient potassa to neutralise both the picric and undecomposed nitric acids. I find that 1 part of sulphophenate in 50,000 parts of water, boiled with nitric acid and saturated with potassa, appears distinctly yellow in a stratum 1 inch deep, and that 1 part of phenol in 100,000 parts of water, treated in the same manner, produces an equal depth of tint. The tri-nitrophenate of potassa, requiring 260 parts of cold water for solution, is easily crystallised in its beautiful slender yellow needles.

The *composition* of sulphophenic acid authorises its classification with the sulphovinic acids, and the brotherhood of their derivatives indicates close relationship between phenol and the alcohols. The exceeding interest of these chemical analogies is enhanced by the fact that both sulphophenates and sulphethylates are at the present time on trial as therapeutic agents, and that both are believed to suffer similar and gradual decompositions in the animal body—the former furnishing phenol as a medicinal agent, and the latter yielding sulphate as the active agent. Phenol has the composition of a monatomic alcohol; it is neutral to test-papers, and its combinations with bases are scarcely stable enough to be classed as salts.

Sulphethylic acid is much less stable than sulphophenic acid; the former in dilute solutions decomposes gradually in the air and more rapidly on boiling, while the latter may be concentrated on the water-bath or even boiled without injury. The former decomposes at its own boiling-point, evolving oxide of ethyl; the latter decomposes at the boiling-point of phenyl hydrate, which distils, for some time, intact. An attempt to produce phenic ether by distillation from sulphophenic acid serves to show that, if possible, it must succeed by the introduction of peculiar conditions. When the boiling-point rises above that of phenol, that substance has mostly passed over, and sulphurous acid and quite indeterminate oxidised products appear. The double oxides of phenyl and methyl, phenyl and ethyl, phenyl and amyl, &c., are well known, but may perhaps as well be considered phenates as conjugated ethers, certainly simple phenic ether has not been obtained from them. Scrugam inferred the production of oxide of phenol in the reaction between chloride of phenyl and phenate of sodium, heated, but distillation failed to furnish the supposed product. Finally, Hoffmeister (*Deut. Chem. Ges. Ber.*, iii., 747, and *Journ. Chem. Soc.*, April, 1871) has declared the production of oxide of phenyl by distilling phenol with sulphate of azophenylamine.*

The purified phenic ether is a colourless solid, melting at 82° F., and boiling at 478° F. (or 190° above the boiling-point of phenol). The difficulty of phenic etherification seems to be explained in the fact that the ether has a higher boiling point than its alcohol. The new product is described as very stable, having an agreeable aromatic odour, and its therapeutical properties will be looked for with interest.

Should it be found that sulphophenates are producible with other than the typical formula, $MO.C_{12}H_5O.2SO_3$ (or

* $HC_6H_5N_2SO_4 + HC_6H_6O = (C_6H_5)_2O + H_2SO_4 + N_2$.

$MC_6H_5SO_4$), the fact will scarcely present a dissimilitude with the sulphethylates. For we have ethionic acid, $C_4H_6O_2.4SO_3$ (in the salts of which two molecules of base are substituted for two of water), and isomers of sulphethylic acid are described.

An analysis of selected crystals of sulphophenate of barium, dried in fine powder at 212° F., until it ceased to lose weight, gave the following results for 1000 grms. :—

	Found.	Calculated from $BaO.C_{12}H_8O.2SO_3$.
BaO	0·3165	0·3167
SO_3	0·3224	0·3312

The baryta was precipitated with dilute sulphuric acid. For the determination of the sulphuric anhydride, the salt was decomposed with strong nitric acid on the water-bath, in the presence of an excess of nitrate of barium; most of the nitric acid evaporated, and the remainder nearly neutralised with potassa, and the precipitate washed first by decantation and then on a filter in the usual manner. It is difficult to decompose by nitric acid without loss of sulphuric acid, unless in the presence of excess of barium salt.

It is stated (*Rabantan, Schmidt's Jahrbucher*, 148, 610) that sulphethylate of sodium, when administered, very gradually splits into sulphate of sodium and alcohol in the alimentary canal, and the dose of the sulphethylate may be 380 grains—not higher than the dose of sulphate.

Dr. Sansom (*Practitioner*, 1869, July) states that after the administration of sulphophenates, an increased quantity of sulphates appears in the urine, while the breath bears the odour of phenol. He gives doses as large as 1 dram, which, if fully decomposed in the body, would yield over 20 grains of phenol, or many times the dose of this agent. Thus the therapeutical potency of these agents shows that sulphophenates are less easily decomposed than sulphethylates, in the animal body as well as in the laboratory.

MINERALOGY.

The second lecture of the course, by W. W. Smyth, F.R.S., was on "Calcareous or Lime-Containing Minerals."

In the minerals included under this term, lime (Latin, *calx*) forms the principal constituent. The first of the series is that known as "calcite," which the lecturer characterised as one of the most protean substances in Nature. Its percentage chemical composition is—CaO, 44; CO_2, 56. In its purest state it is frequently found as crystals, associated with the ore of lead, or lining the joints and fissures which are so common in limestone rocks: in the latter case it is sometimes in crystals, sometimes in the form of layers on the sides of the fissure. A variety of calcite known as "dog-tooth spar" is of frequent occurrence in the central parts of England. Calcite crystallises in the hexagonal system, and possesses some wonderful and interesting physical properties. One of the most remarkable is that of double refraction, which is seen to great advantage in crystals of Iceland spar, although not peculiar to that substance. It consists in the splitting up of an incident ray of light into two portions, which in their passage through the crystal are more or less separated from each other, the distance of separation increasing with the thickness of the crystal. Two fine specimens were exhibited; one in its native state, with a smoky film on its surface; the other, which had had this film cleaved off, was beautifully transparent, and on looking at a wafer placed beneath two distinct figures of it might be seen. Another property which calcite possesses, in common with some other minerals, is that of cleavage, by which all the pieces of a broken crystal will take the same form as the perfect crystal, or at least have the same angular measurements.

Another group in the series is that of the marbles, which was known to the ancients, and applied by them to ornamental purposes. They gave the name "marble" (from a Greek word, meaning "to shine") to any substance which would take a polish and was capable of being applied to decorative purposes. We restrict the term to carbonates of lime, of a certain degree of hardness, and susceptible of a certain amount of polish. One of the purest varieties of marble, and one which was highly valued in olden times for sculptural purposes, is that known as "Parian marble," which is obtained from the Island of Paros, in the Grecian Archipelago. Another variety, which is far more common amongst us now, is the Carrara marble, which, under the name of Marmor Lunensis, was in great repute in the time of the Roman Empire. The modern town of Carrara stands on the shores of the Gulf of Genoa, and the entire population of the place is supported by the produce of its marble quarries. There are other varieties of Carrara marble besides the pure white statuary rock, marked in various ways; and in fact there are frequently, in all limestone districts, numerous varieties which are quite peculiar to that district. Thus we have black marble from Kilkenny, in Ireland, and extremely varied kinds from Derbyshire and Yorkshire. But as a rule the limestones of this country, in point of beautiful colours, are inferior to those of the South of Europe, the only notable exception being a variety, Devonian marble, from near Torquay.

The Lecturer also remarked, as a curious fact, that as you proceed southward in Europe you find a more and more extensive use of these beautiful stones, and of other natural productions, in domestic architecture, and expressed a desire to see this practice more common in this country. But the wealth of this country in these kinds of rocks consists in the vast beds of "limestone," generally so-called, which are carbonates of lime more or less incapable of taking a fine polish. These stores of limestone have not yet been developed to their full extent, and, speaking generally, the mineral resources of our island have not been properly investigated; in many cases we have had to depend for supplies on foreign sources. The chief object of this Museum of Practical Geology is to illustrate and teach what is known and what is being discovered on this subject.

This same substance is also found in the form of stalactites and stalagmites, so frequently to be seen in the caverns of limestone districts. The name "stalactites" is given to those masses which hang pendant from the roof, "stalagmites" to those which rise from the floor. Their principle of formation is due to the fact that water, holding carbonic acid in solution, is capable of dissolving and carrying away portions of limestone, leaving, in most cases, hollows or caverns in the rocks; and this explains the prevalence of caverns in limestone districts. The carbonic acid is derived by rain water, partly from the air and partly from decomposing vegetable and animal matters. When the water evaporates the lime is left behind,—as, for instance, in the case of the drops in the roof of the cavern,—and a stalactite is formed, and grows by the addition of matter from the water trickling down outside it, though sometimes there is a narrow pipe down the centre of the mass. A section across one of these is often curiously variegated, both in the colour and form of the various layers, and in this way (more especially by sections of the stalagmites) the ancients obtained what they termed "alabaster," or what is now known as "Algerian onyx."

The hydrated sulphate of lime, or gypsum, is quite distinct from the above carbonates; it crystallises in the oblique system. Fine crystals of it are found in the counties of Nottingham and Derbyshire, where it is manufactured into plaster of Paris by merely driving off its water. Its composition per cent is—CaO, 32·6; SO_4, 46·5; H_2O, 20·9.

A phosphate of lime is also known, under the name "apatite," in which 89 to 92 per cent of calcic phosphate is combined with fluoride or chloride of calcium. Great

quantities of this phosphate of lime have been imported for use as artificial manure.

Fluor-spar is another calcareous mineral found crystallised in cubes, of various colours, the purples and blues predominating. It is known in Derbyshire as "blue John," and is capable of being worked into most beautiful objects. Its percentage composition is—Ca, 51·9; F, 48·1.

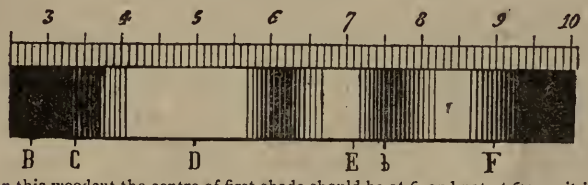
FLUORESCENT RELATIONS OF CERTAIN SOLID HYDROCARBONS FOUND IN PETROLEUM DISTILLATES.

By HENRY MORTON, Ph.D., President of the Stevens Institute of Technology.

When the residues left in the distillation of petroleum for the manufacture of illuminating oils are re-distilled to obtain lubricating oils and paraffin, there passes over near the close of the operation, and when the still is at the bottom almost or even quite red-hot, a thick tarry matter of a sepia colour, which is used like the corresponding product of coal-tar distillation as a lubricant for very heavy and rough machinery, such as the necks of the rollers in iron rolling-mills.

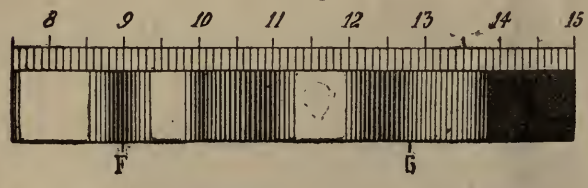
A specimen of this was given to me in the early part of last February by Prof. E. H. Horsford, and on examination and treatment with benzine, alcohol, and ether, I extracted from it a solid crystalline body of a yellow-green colour, and remarkable fluorescence. This I described under the name "viridin" in a paper read before the American Institute in New York, on the 29th of March, and drew attention to the very remarkable spectrum which its fluorescent light yielded, which resembled in a remarkable manner that of anthracene, while the crystalline form, solubilities, and fusing-points of the two bodies were decidedly unlike.

Fig. 1.



In this woodcut the centre of first shade should be at 6, and not at 6·2, as it is.

Fig. 3.



The amount of material given me by Prof. Horsford was, however, insufficient for further study, and I encountered some difficulty in obtaining a fresh supply. At last through the kindness of my friend, Dr. G. F. Barker, with whom I am now engaged in a thorough investigation of the properties of this material, I was introduced to Mr. John Truax, who has kindly supplied me with an abundance of the required material with which the observations about to be described were made.

To make clear what follows, I must say a few words about the preparation of the substance, although for all details I would refer to the paper by Dr. Barker and myself, to appear subsequently.

The crude tarry matter is well washed with benzine (petroleum naphtha), then with alcohol, and is lastly dissolved in benzole (coal-tar naphtha), filtered hot, and crystallised out on cooling. It is then obtained as a mass of very minute needle-like crystals, of a greenish-yellow colour and pearly lustre in the mass. If a portion of this is illuminated with light which has passed through a tank of ammonio-sulphate of copper, it is seen to emit a brilliant green light, and if this is examined with a spectroscope the spectrum shown in Fig. 1* is seen.

The method actually employed for these observations is represented in Fig. 2 where A represents a port-lumière with a lens of about 12 inch focus at B, a tank of ammonio-cupric sulphate in front of that, and in the focus of the lens a little bottle containing the substance supported in a rotating stand, C, so arranged with a "click" that one bottle after another could be brought rapidly into an identical position.

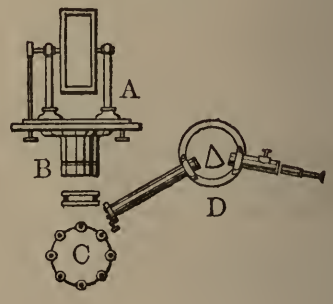
A Browning's one-prism spectroscope was then employed at D to examine the fluorescent light.

If now we fuse a portion of this substance with paraffin and allow it to cool in a thick layer on glass, and examine the light which it will transmit, we shall find that it yields an absorption-spectrum such as is shown in Fig. 3. First comes a relatively narrow and sharply defined band about F, then a very broad and less sharply defined line which contains two maxima of absorption, one about 10·1, and the other about 10·9, of the scale. Lastly, we have a yet more indefinite band about 12·5 reaching to G, and connected by a shade of slight general absorption with the point about 14 of the scale, above which the absorption is total.

The detail of the method of observation here employed is illustrated in Fig. 4, where A is the port-lumière, B a lens of 12-inch focus, C a tank of ammonio-cupric sulphate, D the object to be examined, and E the spectrocope.

These absorption-bands are not only to be seen in the mixture of the above-described body, which I may as well call thallene hereafter to avoid circumlocution, with paraffin, but also in the thallene alone when fused into a thin film by heating between two pieces of mica, and even in paper coated with a mixture of thallene and demar varnish.

Fig. 2.



If now a pure spectrum of sunlight is thrown on a screen of paper coated with the mixture of thallene and varnish last mentioned, it will be observed that a strong fluorescence is excited by all the rays above 8·5 of the scale, but having decided maxima corresponding with the absorption-bands shown in Fig. 3, and a very intense fluorescence of a rich green colour beginning about 14 where the absorption is total. Below this point the fluorescent light combined with that of the spectrum gives a white ground on which the Fraünhofer lines show with remarkable distinctness. The two H lines come out beautifully on the bright green above 14, and with prisms

* The scale used for all these drawings of spectra is that introduced by Bunsen, with millimetre divisions.

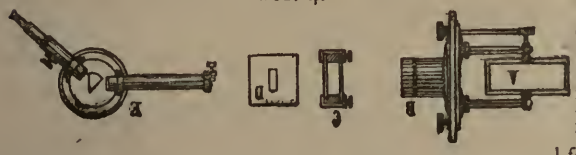
and lenses of quartz the spectrum lines can be seen to a great distance above always on a bright green ground.

As a screen on which to project and study the lines of the extra violet spectrum, either of sunlight or of various elements as described by Stokes,* this substance applied as above seems to exceed very decidedly in brilliancy of effect the peculiar uranium phosphate used by that investigator.

In fact, if, with a brush filled with what we might call this thallene varnish, we write or paint words, or leaves of flowers and the like on a card, and then view it by light which has passed through cobalt glass, the writing or figures seems to be self luminous, so bright is its fluorescence, exceeding even that of the platino-cyanide of barium, which was heretofore the most brilliant solid in this respect. I have just prepared in this way, for a lecture illustration, a flower some 10 feet across, using the above material to paint the leaves and buds, and another to be presently described for the petals, and find that with a lime-light lantern and cobalt glass it lights up in a very surprising manner. With an electric light of course the effect is still better.

In a lecture which I delivered last week (Nov. 6) in the Opera-house in Philadelphia, which seats 3500 auditors, I used a screen 8 feet long by 2 feet wide coated with this substance, and placing it beyond the violet end of a

Fig. 4.



spectrum thrown from an electric light with 60 Bunsen's cells and two bisulphide of carbon prisms, I found that many of the lines of copper, silver, magnesium, and other metals which were invisible on a screen of paper, come out so strongly that they were plainly viewed by every individual in the audience which filled the building on that occasion.

Fig. 5.

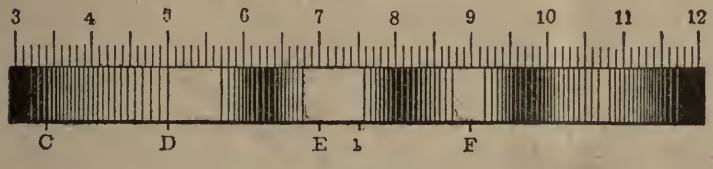
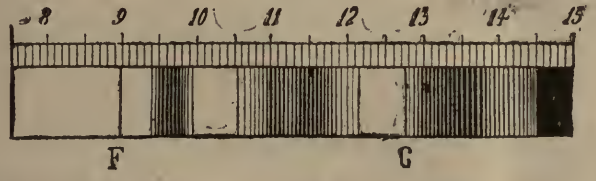


Fig. 6.



Thallene in Solution.—If this substance is dissolved in benzol which will take up at the ordinary temperature about 1 part to 150, a rich yellow liquid is obtained fluorescing with a blue colour and considerable intensity; and when this light is examined with the spectroscope it is found to resolve itself into a spectrum which is indicated below in Fig. 5. Comparing this with Fig. 1, and bearing in mind the correction required in the first band of that figure, it will be seen that in the spectrum of the fluorescent light given by the solution, all the bands are moved towards the more refrangible end of the spectrum.

Thus in the spectrum of the solid we have the centres of the principal bright bands at 6·8 and 8·4, and in that of the liquid at 7·2 and 8·9. In addition to this we perceive that a new bright band has made its appearance at 10·7. On careful examination of the solid, however, in a very strong light, and with a plate of violet glass added to the ammonio-cupric sulphate tank at c (Fig. 4), it appears that a corresponding band exists at about 9·8, though it is very faint. If now we change the solvent to chloroform, in which the thallene dissolves to about the same extent as in benzole, we find the displacement of bands still the same, or not appreciably different.

If, however, we use ether, which dissolves but a small amount, we find the bands displaced yet further up; the principal bright bands, which in the solid are at 6·8 and 8·4, in the benzol solution at 7·2 and 8·9, are in the ethereal solution at 7·4 and 9·2. The spectrum of the solution in alcohol, which dissolves but about 1 part to 12,000, is very much like that of the ethereal solution, as is also the spectrum given similarly with solution in turpentine; that in olive oil is between the solutions in benzole and ether in the upper displacement of its bands.

On the other hand, a solution in carbon-bisulphide shows a displacement of the bands only about half as great as that observed with the solution in benzole.

In all cases of solution we find an elevation of the bright bands in the spectrum; and it is without doubt to this, mainly, that is due the general change in the colour of the fluorescent light, from green in the solid, to blue in all of the solutions.

If now we observe the solutions in the manner indicated in Fig. 4 (and for this purpose I find it very convenient to place them in bottles of white glass of one ounce capacity, these bottles forming cylindrical lenses of a convenient focal length to throw a large amount of light into the slit of the spectroscope), we shall find that the absorption-bands, like those of fluorescence, are displaced upwards, and to a similar degree, without, as a rule, any other change.

This is shown in Fig. 6, which represents the absorption-spectrum of the solution of thallene in benzole.

In the case of the solutions in carbon-bisulphide and in turpentine, it should be observed that the band nearest to F is entirely, or almost entirely, wanting, while the other two are well defined and very strong.

When a glass tank is filled with one of these solutions, and a pure spectrum is projected upon its vertical side, distinct maxima of fluorescence are observed in places corresponding with the absorption-bands, exactly as was the case when the solid thallene was used similarly as a screen, the maxima now, of course, coinciding with the displaced absorption-bands of the solution.

On looking down into the tank, long trails of fluorescent light are seen running into the solution at each maximum, these varying in tint from green in the band near to F, blue in the next, then blue-green, and in the uppermost a purplish blue.

All the actions which have been heretofore described with this body find a parallel in impure anthracene (*i.e.*, chrysogen), except that the absorption-band near F is not lost or diminished by solution in carbon-bisulphide or turpentine, and that it shows no band of fluorescence corresponding with the uppermost one of thallene.

Quite early in my observations on thallene I had noticed that its solutions, as also those of anthracene, when exposed for a short time to sunlight, ceased to give any bands of absorption, and as soon as I had established with anthracene that this was connected with the destruction and removal of a companion body (chrysogen), I tried the effect of a similar treatment upon a benzole solution of

* *Phil. Trans.*, 1862, ii., p. 602.

thallene. If a solution of this body in benzole is exposed, cold, to bright sunlight for five minutes, the band near F disappears, but it requires an exposure of at least half an hour to remove the other bands. Using a hot solution, and crystallising out the material on cooling, I found that more than two hours were needed to produce thoroughly a change presently to be described, and a much longer time with a cold solution; I therefore had recourse to a large burning-glass of about 16" diameter and 3 feet focus, which was in our cabinet, and found that an exposure of ten minutes near its focus was enough to modify a 4-oz. flask, full of hot saturated solution. After such treatment the solution shows no absorption-bands, and only a total absorption above 14·5 ; and when, on cooling, crystals are separated, they are seen to have lost their yellow colour and green fluorescence, and are of a slightly leaden tint, and fluoresce bright blue. The spectrum of this fluorescent light shows an upward displacement of the bands a little greater than that given by the solution in ether.

To indicate the body in this condition, I would propose the name "petrollucene."

When a solution of this substance in benzole is examined, by allowing a pure spectrum to fall upon it, the maximum corresponding to the lower absorption-band is found to be entirely wanting; but the two upper maxima, one a little below G, and the other half-way between G and H, are still strongly shown, and have long trails of light running from them far into the solution.

Beside certain additions, which it will be observed that I have made to the actions of chrysogen given in a previous paper (see Chemical News, vol. xxvi., p. 199), two errors should be corrected. On page 201, first column, fourth line from foot, "green" should be "blue;" and on the second column of the same page, near the end of the fourth paragraph, "700° F." should be "460° F."

ADULTERATION OF CHEMICALS.

Acetic acid is frequently weakened with water, and adulterated with sulphuric ether. Six samples tested with chloride of barium gave a precipitate of sulphate of barium in varying proportions.

Muriatic acid and sulphuric acid, sold as chemically pure, have both been found contaminated; the former with arsenious and sulphurous acids, the latter with a large proportion of sulphate of lead.

Tartaric acid has been met with containing 50 per cent of sulphate of magnesia. Alum is also said to be used as an adulterant, but the reporter had not met with a specimen.

Alum frequently contains iron, probably arising from carelessness in the manufacture. The presence of free acid has also been noticed, especially in the English article.

Carbonate of ammonia is sometimes substituted by a compound made from solution of ammonia, glue, and bicarbonate of soda, which forms when dry a hard translucent mass, resembling genuine carbonate.

Muriate of ammonia is sometimes met with of very poor quality; iron is often visible on the surface and becomes still more so when dissolved. The report recommends that the purified granular salt should be the only one sold at the dispensing counter.

Black sulphuret of antimony has been met with containing sulphite of lead (galena), quartz (30 to 40 per cent), clay, &c. A good article, however, is procurable.

Powdered arsenic is sometimes adulterated with sulphate of lime or sulphate of baryta; the pharmacist is, therefore, recommended to purchase the lump arsenious acid.

Bismuth (metal) generally contains arsenic. An instance is mentioned in the report where 400 lbs. of antimony were sold by a broker to a manufacturer for bismuth. Fortunately for the latter, he detected the error before the transaction was completed.

Subnitrate of bismuth has been reported as adulterated with 20 per cent of phosphate of lime; but it is believed that the salt made in the United States by the principal manufacturers is free from adulteration.

Citrate of iron and quinine is seldom found made strictly according to the United States formula, which does not produce a sufficiently soluble salt. Some manufacturers, therefore, add citrate of ammonia to make it soluble, and others leave out a considerable portion of the quinine to accomplish the same end. There is also a probability that in some cases cinchonine is substituted for the quinine.

Chloral hydrate has been met with containing the alcoholate. The tests pointed out are the difference in boiling-point, sulphuric acid, which leaves pure hydrate colourless, but turns alcoholate brown, and nitric acid, which gives little or no reaction with hydrate, but reacts violently with alcoholate, giving off nitrous oxide gas.

Chloride of calcium has been noticed at Chicago with a large excess of caustic lime, and it is known to have been sold in crystals without any allowance made.

Chloroform is sometimes met with diluted with alcohol, and sometimes not sufficiently purified, and, therefore, unfit for inhalation. There is also reason to believe that partially decomposed chloroform has been sold through ignorance on the part of the dispenser. Nitrate of silver is useful in detecting this decomposition, by giving a precipitate of chloride of silver with the liberated chlorine.

Cream of tartar is grossly adulterated, and the distinctive terms are said to be well known to mean varying proportions of *terra alba* and cream of tartar.

Epsom salt has been substituted in the Western market by finely crystallised Glauber's salt. As the prices, however, are now about the same, this is not likely to recur.

Ether is sometimes sold containing a large proportion of alcohol. This may probably arise from the druggist dispensing photographic concentrated ether, made to contain alcohol in order to dissolve the gun-cotton.

Iodoform has been noticed of a light canary colour, a considerable portion being insoluble in ether; probably iodate of lime.

Acetate of lead has been in the market containing a large percentage of crystallised nitrate of lead; one lot was offered, to a maker of preparations for the hair, as "damaged," which proved to be damaged sulphate of zinc, in lumps.

Precipitated carbonate of lime has been offered containing sufficient iron to give it a light fawn colour; supposed to be ordinary chalk, dressed.

Sulphate of morphia is frequently open to suspicion. In one case the sample did not contain any morphia; placed on a red-hot plate, it did not seem to lose any weight, and it was insoluble in water. A fraud in which sulphate of quinine was put into sulphate of morphia bottles has been lately detected in New York.

Phosphorus, according to Dr. Rademaker, sometimes contains arsenic.

Bromide of potassium has been observed to contain a considerable quantity of water of hydration.

Iodide of potassium is often adulterated with the bromide; some made in New York was found to contain carbonates in considerable quantity.

Sulphate of quinine has many adulterants; among them sulphate of lime; cinchonine, sold as "sweet quinine" or as "cinchoquinine;" muriate of cinchonine, sold as "light sulphate of quinine" and as "French quinine," salicine, &c.

Rochelle salt has been offered for salt containing at least 25 per cent of sulphate of soda.

Santonine was seen last year. in the New York market, contaminated with small particles of mica. This fraud may easily be detected by placing the suspected sample on a hot plate; the santonine will disappear and leave the mica.

Nitrate of silver (made for the Government), which contained 5 per cent of copper, was sold in Chicago.

Pieces could be picked out emerald-green in colour; it appeared to have been made by simply dissolving coin or other alloy of silver in nitric acid, and crystallising without any attempt at purification.

Precipitated sulphur is reported as usually free from sulphate of lime, and the United States pharmacist is congratulated on this superiority to the English article; but a proportion of 50 per cent of gypsum in flowers of sulphur is reported as having been noticed, and sometimes ground sulphur is sold for the sublimed.

Tartar emetic has been met with containing 11 per cent of cream of tartar.

Spices, on account of their widely extended use, are largely adulterated, and some startling revelations might be made if a spice miller could be persuaded to disgorge his ill-gotten knowledge. The only safe way to get pure powdered drugs is to pay a good price, and buy from conscientious persons who are above suspicion.

Cochineal is adulterated with sulphate of barytes, a heavy white powder, which, when shaken with the insects, lodges in the wrinkles and crevices on the surface of the body. The weight is thus increased sometimes from 15 to 25 per cent.

Balsam of copaiba is often mixed, and sometimes found entirely fictitious, being composed of a mixture of castor-oil, resin, and oil of copaiba. Powdered ipecacuanha is sometimes so adulterated and weakened that tartar emetic is necessary to strengthen it. Oil of lemon mixed with 30 per cent of fixed oil has been met with.

Powdered opium is often mixed with powdered extract of liquorice. In fact, some dealers uniformly send to the grinders a certain proportion of liquorice with the opium, so that they might be ground together. Powdered rhubarb is frequently adulterated with curcuma. Sometimes senega root is mixed with cypripedium.

Castile soap frequently contains an undue proportion of water. It has been met with containing as much as 30 per cent. Acetic acid is also mixed with water, acidulated with dilute sulphuric acid.

Subnitrate of bismuth has been found mixed with phosphate of lime to the extent of 20 per cent; and citrate of iron and quinine is adulterated with citrate of ammonia, and contains less quinine than called for, 10 or 15 per cent instead of 25 per cent. Quinine itself is frequently met with mixed with cinchona, muriate of cinchona, and salicine.

Santonine has been found adulterated with small particles of mica, and cream of tartar frequently mixed with tartar emetic. Cream of tartar is grossly adulterated; the terms "strictly pure, pure, No. 1 and No 2," being used to indicate varying proportions of cream of tartar and *terra alba*, the latter material being largely imported from Europe for the express purpose of adulterating, the importations amounting to many tons annually.

Chloroform is sometimes diluted with alcohol, and iodide of potash in crystals mixed with bromide, and occasionally with bicarbonate of potash. Solid extracts are also much adulterated.

In the manufacture of syrup, a considerable portion of the sugar is replaced by glucose, especially in making fruit syrups.—*Proceedings of the American Pharmaceutical Association.*

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

General Monthly Meeting, December 2, 1872.

SIR HENRY HOLLAND, Bart., M.D., D.C.L., F.R.S., President, in the Chair.

THOMAS Thompson, jun., Esq., and Sidney Waters, Esq., were elected as Members of the Royal Institution. The following lecture arrangements for the ensuing season were announced:—

Christmas Lectures (adapted to a Juvenile Auditory).

Professor Odling, M.A., F.R.S. Six lectures "On Air and Gas," on Dec. 28 (Saturday), Dec. 31, 1872; Jan. 2, 4, 7, 9, 1873. Before Easter, 1873.—Professor Rutherford, M.D., F.R.S.E. Twelve lectures "On the Forces and Motions of the Body," on Tuesdays, Jan. 14 to April 1. Dr. Debus, F.R.S. Three lectures "On Oxidation," on Thursdays, Jan. 16, 23, 30. Dr. H. E. Armstrong, F.C.S. Four lectures "On the Artificial Formation of Organic Substances," on Thursdays, Feb. 6 to Feb. 27. A. Vernon Harcourt, Esq., M.A., F.R.S. Five lectures "On the Chemistry of Coal and its Products," on Thursdays, March 6 to April 3. Edward A. Freeman, Esq., D.C.L. Six lectures "On the Comparative Political Institutions of Different Nations," on Saturdays, Jan. 18 to Feb. 22. Professor W. K. Clifford, M.A. Three lectures "On the Philosophy of the Pure Sciences," on Saturdays, March 1, 8, 15. Professor Max Müller, LL.D. Three lectures "On Darwin's Philosophy of Language," on Saturdays, March 22, 29, and April 5. After Easter.—John Morley, Esq. Three lectures "On the Limits of the Historic Method," on Tuesdays, April 22 to May 6. J. H. Parker, Esq., C.B. Four lectures "On the Evidence for the Traditional History of Rome from Existing Architectural Remains," on Tuesdays, May 13, 20, 27, and June 3. Professor Tyndall, LL.D., F.R.S. Six lectures, on Thursdays, April 24 to June 5. Professor Odling, M.A., F.R.S. Four lectures, on Saturdays, April 26 to May 17. Edward Dannreuther, Esq. Three lectures "On the Development of Music in Connection with the Drama," on Saturdays, May 24, 31, and June 7.

The Friday Evening Meetings will commence on January 17.

Friday Evening Discourses during the Season will probably be given by Wm. Spottiswoode, Esq., the Rev. Professor T. R. Birks, Edward Dannreuther, Esq., R. H. Scott, Esq., Robert Sabine, Esq., Sir H. Rawlinson, K.C.B., Professor Clerk Maxwell, James Dewar, Esq., E. J. Reed, Esq., C.B., J. Emerson Reynolds, Esq., Professor W. K. Clifford, Professor Tyndall, Lord Lindsay, Professor Odling, and others.

The presents received since the last Meeting were laid on the table, and the thanks of the Members returned for the same.

MISCELLANEOUS.

The Royal Society.—At the annual meeting of the Royal Society, held at Burlington House on November 30, the following gentlemen were appointed officers and council for the ensuing year:—*President*—Sir George Biddell Airy, K.C.B., M.A., D.C.L., LL.D., Astronomer Royal. *Treasurer*—William Spottiswoode, M.A. *Secretaries*—Professor George Gabriel Stokes, M.A., D.C.L., LL.D.; Professor Thomas Henry Huxley, LL.D. *Foreign Secretary*—Professor William Hallowes Miller, M.A., LL.D. *Other Members of the Council*—George James Allman, M.D.; Sir B. C. Brodie, Bart., M.A., D.C.L.; George Busk, F.R.C.S.; Professor Robert Bellamy Clifton, M.A.; James Fergusson, D.C.L.; Thomas Archer Hirst, Ph.D.; J. Dalton Hooker, C.B., D.C.L., LL.D.; Joseph Prestwich, V.P.G.S.,; Rear-Admiral G. H. Richards, C.B.; Professor H. Enfield Roscoe, B.A., Ph.D.; Philip Lutley Sclater, M.A.; William Sharpey, M.D., LL.D.; Francis Sibson, M.D.; Major-Gen. R. Strachey, R.E., C.S.I.; Isaac Todhunter, M.A.; Sir Charles Wheatstone, D.C.L.

Royal Institution.—The two Actonian Prizes of £105 have been awarded by the Managers of the Royal Institution to the Rev. George Henslow and to Mr. B. Thomson Lowne, for Essays "On the Theory of the Evolution of Living Things."

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, November 25, 1872.

This number is entirely devoted to the general annual meeting of the Academy, at which the prizes are distributed, and reports read concerning them.

Les Mondes, November 28, 1872.

Annual Public Meeting of the Academy of Sciences; Distribution of the Prizes for 1870 and 1871.—From the contents of this paper we abstract the following particulars:—The Lalande prize for astronomy has been given to Mr. Huggins, as an acknowledgment of his researches on the physical constitution of the stars, planets, comets, and nebulæ. The Jecker prize (chemistry) has been given to MM. De Clermont, Gal, and Grimaux; to each of these has been given the sum of 7000 francs (£280), as an acknowledgment for their chemical researches. The Barbier prize has been given to M. Personne for his researches on chloral. The prizes for 1871 relating to chemistry and collateral sciences have been distributed as follows:—The Jecker prize to Dr. Schützenberger, as an acknowledgment for his labours in organic chemistry. The Barbier prize to Dr. Duquesnel, for a memoir on crystallised aconitine. The Montyon prize and 2500 francs (£100) to M. Goldenberg, for sanitary improvements made in his manufactory. 2000 francs to M. Louvel for his process of preserving grain in vacuum.

Obituary.—Professor Klebsch, of Göttingen, one of the most eminent mathematicians of the day, has just died at the early age of forty; the deceased was a lso well known for his studies in astronomy and physics.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 17, 1872.

This number opens with an address of Dr. Liebreich, congratulating the President (Dr. A. W. Hofmann) and the members of the Society on the fifth anniversary of the foundation of this society, already one of the most successful scientific societies established in Germany; the speaker gives a review of the history of the past lustrum, and pays a well-deserved tribute to Dr. A. W. Hofmann, to whose energy the success of the society is in a great measure due. Dr. Oppenheim proposed that a subscription list should be opened for the benefit of the orphans of the late J. C. Brough; the amount subscribed up to November 18, was 158 thalers = £23 14s.

The following original papers and memoirs are contained in this number:—

Researches on the Uric Acid Group.—M. Nencki.—After referring to his former researches on this subject, the author states that, when barbituric acid is treated with cyanogen gas, there is formed cyan-malonyl-urea, $C_6H_4N_4O_3$; the formation of this body from barbituric acid is simply due to the addition thereto of cyanogen, and takes place according to the following formula:—

$$C_4H_4N_2O_3 + C_2N_2 = C_6H_4N_4O_3.$$

Cyan-malonyl-urea is not decomposed by boiling with water; it is a solid crystalline substance, which, when heated to 240°, gives a small sublimate, but is mainly carbonised and decomposed. Strong sulphuric acid decomposes cyan-malonyl-urea at 100°; carbonic acid is evolved, and several new products formed. By the action of caustic potassa solution, a new acid is formed, which the author terms cyan-uromalic acid; the potassa salt of this acid has the formula $C_6H_2KN_4O_4$. The free acid is a solid substance, difficultly soluble in water, but this substance is an unstable compound, because it is slowly decomposed by contact of air, hydrocyanic acid being given off; the formula of the free acid is $C_6H_6N_4O_4$. The acid alluded to is, according to the author's researches (compared with those of Baeyer, *Ann. d. Chem. u. Pharm.*, vol. cxxxv., p. 312), identical with malobiuric acid—

$$N_2\left\{\begin{matrix}(CO)_3\\C_2H_2O_2\\H_2\end{matrix}\right.$$

Dehydration (Wasserentziehung) as Taking Place in the Animal Organism.—M. Nencki.—Reserved for full translation; an observation also applying to the following essay:—

On Ultramarine.—C. Unger.

On Nitro-Naphthalines.—A. de Aguiar.—This exhaustive essay treats on dinitro-naphthalin-α, which is soluble in glacial acetic acid; it is a yellow-coloured crystalline substance, and, when treated with strong nitric acid, yields some trinitro-naphthalin, but chiefly tetra-nitro-naphthalin-α, and also nitro-phthalic acid, $C_6H_3(NO_2)COOH$. The crystallographical features of this body are described at length, and illustrated by woodcuts; the chemical properties agree with those described by Marignac. Nitro-phthalate of baryta is a crystalline salt barely soluble in water; it contains no water of crystallisation; formula—

$$C_6H_3(NO_2)\left\{\begin{matrix}CO.O\\CO.O\end{matrix}\right\}Ba.$$

Nitro-phthalate of silver is an amorphous compound, soluble in acids, and exploding when heated; formula—

$$C_6H_3(NO_2)\left\{\begin{matrix}CO.O\\CO.O\end{matrix}\right\}Ag_2.$$

A considerable portion of this essay is devoted to a comparative review of the author's and Dr. Beilstein's researches on this subject; the modes of preparation of the above compounds are also exhaustively described.

On Triphenyl-Methan.—A. Kekulé and A. Franchimont.—In the introduction to this paper the authors observe that it has become customary to view the hydrocarbons of the benzol series as derivatives from benzol, for the hydrogen atoms of which have been substituted monovalent *(einwerthige)* alcohol radicals; instead of this view being taken, the hydrocarbons just mentioned might be referred to substances of the fatty bodies, by considering that for a certain number of hydrogen atoms of these, remnants *(reste)* of benzol have been substituted. This has already been done for the alcohols, aldehydes, and acids of the aromatic series, and when applied to the aromatic hydrocarbons starting from methan, the simplest hydrocarbon of the group of the fatty bodies, the following series will be obtained:—

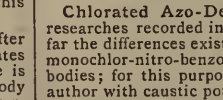
$CH_3.C_6H_5$, phenyl-methan, synonymous with toluol.
$CH_2.(C_6H_5)_2$, diphenyl-methan, „ „ benzyl-benzol.
$CH.(C_6H_5)_3$, triphenyl-methan.
$C.(C_6H_5)_4$, tetraphenyl-methan.

The preparation of triphenyl-methan from mercuro-diphenyl is then described at length; the pure substance is a solid crystalline body, fusing at 92·5°, boiling at 355°, insoluble in water, readily soluble in ether, boiling alcohol, and boiling benzol. Triphenyl-methan forms with benzol a solid crystalline combination, which fuses at 76°, the benzol being gradually eliminated by the application of a higher temperature, so that at 92·5° there is only triphenyl-methan left; the simplest formula of this body is $C_{19}H_{16}$, while its constitutional formula is that quoted above. With fuming sulphuric acid, triphenyl-methan forms a sulpho acid; formula, $CH(C_6H_4.SO_3H)_3$; the baryta salt of this acid is soluble in water, but is precipitated from this solution by alcohol.

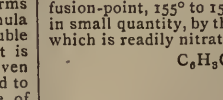
Benzophenon Chloride, and the Formation of Anthrachinon by the Preparation of Benzophenon.—A. Kekulé and A. Franchimont.—The preparation of benzophenon chloride, a rather difficult operation, is first described at length. In pure state, the body is a colourless very refractive fluid; sp. gr. at 18·5° = 1·235; boiling-point, at ordinary barometric pressure, from 298° to 300°, and, with the thermometer fully in the vapour, 305°; it is slowly decomposed by cold water, rapidly so by hot. The researches on the reactions of this body are not yet finished, but the authors observe that, while preparing benzophenon, some anthrachinon was formed; the formation of this body (benzophenon being prepared by the dry distillation of benzoate of lime) is considered due, not to any impurity in the substances employed, but to a peculiar condensation of benzoic acid, elucidated by the fact that anthrachinon has the composition of a second hydrate of benzoic acid—

$$2C_7H_6O_2 - H_2O = C_{14}H_{10}O_3, \text{ benzoyl anhydride.}$$
$$C_{14}H_{10}O_3 = H_2O = C_{14}H_6O_2, \text{ anthrachinon.}$$

Chlorated Azo-Derivatives of Benzol.—K. Heumann.—The researches recorded in this memoir have been made to ascertain how far the differences existing between the two isomeric modifications of monochlor-nitro-benzol are carried over to the derivatives of these bodies; for this purpose α-chlor-nitro-benzol has been treated by the author with caustic potassa solution, the result of the operation, after purifying the substance formed, being the production of a compound, $C_{12}H_6Cl_2N_2O$, dichlor-azoxy-benzol; structural formula—



fusion-point, 155° to 156°. The β-chlor-nitro-benzol yields, although in small quantity, by the same mode of treatment, the same substance, which is readily nitrated, thereby yielding a new compound—

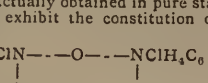


This dichlor-nitro-azoxy-benzol fuses at 134°, is entirely insoluble in water, and is dissolved with difficulty in alcohol; it is crystalline, and is, by the action of fuming sulphuric acid, converted into dichlor-azo-benzol, a solid substance, insoluble in water, somewhat soluble in boiling alcohol; fusion-point, 183°.

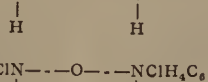
Action of Sodium upon Chlorated Nitro-Compounds.—Dr. A. W. Hofmann and A. Geyger.—This essay contains the account of a series of researches, which were not completed, and also relates to solid chlor-nitro-benzol (fusion-point, 83°), and the action of sodium upon the ethereal solution of that body. The authors obtained, in addition to dichlor-oxyazo-benzol, $C_{12}H_8Cl_2N_2O$, a hydro-compound,

and they presume that a sodium compound, as well as a benzoyl, may exist, but these are not actually obtained in pure state by experiment. The following formulæ exhibit the constitution of these bodies:—

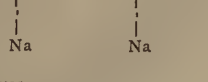
Hydro-compound—



Sodium-compound—



Benzoyl-compound—



Reduction-Products of Nitracetamide Combinations.—F. Hobrecker.—This essay treats on the reduction-products of the nitracetamide combinations when treated with granulated tin and hydrochloric acid; when nitracetamido-benzol is treated in that manner, the result is the formation of diamido-benzol, fusing at 140°, and forming, with platinic chloride, the compound—

$$C_6H_4(NH_2)_2(HCl)_2.PtCl_4.$$

When nitracetamido-toluol is treated as mentioned, the result is the formation of ethenyl-toluylen-diamin, which also combines with platinic chloride. By reduction, nitracetamido-xylol yields a new base, which, in free state, is amorphous, but the chlorhydrate is a crystalline body; formula, $C_{10}H_{12}N_2.HCl$. Composition of platinum salt, $C_{20}H_{24}N_4,(HCl)_2,PtCl_4$. The author further treats on ethenyl-diamido-xylol-urethan (ethenyl-xylen-diamin-urethan) and on ethenyl-triamido-benzol.

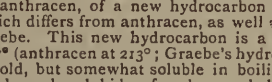
Existence and Dissociation of Tetrachloride of Sulphur.—A. Michaelis and O. Schifferdecher.—This essay, elucidated by a large number of formulæ, treats exhaustively, and with copious references to the labours of a large number of scientific chemists on this same subject, on the best methods of preparation, the properties, and products resulting from the dissociation by heat of the combinations of sulphur and chlorine.

Action of Alkaline Copper Solution on Cane Sugar and on Mixtures of Cane Sugar and Grape Sugar.—C. Scheibler.—The contents of this paper refer to the fact that the researches made by E. Feltz (see CHEMICAL NEWS, vol. xxvi., p. 215) on this subject are not new, since in the year 1869 the author (see *Zeitschrift fur die Ruben Zuckerindustrie im Zollverein*, vol. xix., p. 386), called attention to the reactions alluded to by Feltz.

Action of Perchloride of Phosphorus upon Sulpho Chlorides according to G. A. Barbaglia and A. Kekulé.—A. Michaelis.—This paper, elucidated by a large number of formulæ, contains a discussion on some of the statements made by Barbaglia and Kekulé in an essay published by them on this subject.

New Hydrocarbon Isomeric with Anthracen.—E. Schmidt.—After first briefly referring to Graebe's paper (see CHEMICAL NEWS, vol. xxvi., p. 252), the author describes at length his discovery, in crude mononitro-anthracen, of a new hydrocarbon belonging to the $C_{14}H_{10}$ series, which differs from anthracen, as well as from the body described by Graebe. This new hydrocarbon is a solid crystalline body, fusing at 247° (anthracen at 213°; Graebe's hydrocarbon at 105°); it is insoluble in cold, but somewhat soluble in boiling, alcohol, and readily soluble in benzol, sulphide of carbon, and chloroform. This hydrocarbon combines with picric acid, is not acted upon by nitric acid of sp. gr. 1·2, but readily so by the strongest nitric acid; with sulphuric acid, this substance forms a sulpho-acid.

Another New Hydrocarbon from Coal-Tar.—E. Ostermayer and R. Fittig.—The authors record at length, and elucidate by a series of formulæ, their researches, the result of which is the discovery of another hydrocarbon in coal-tar, or, rather, in one of the heavier oils (boiling above 300°) obtained from tar. The new body is also a solid substance, fusing at from 97° to 99°; boiling-point, above 300°; it combines with picric acid, and forms, by oxidation, a chinon differing from anthrachinon, and yielding, by oxidation, diphenic acid—



Archives Neerlandaises des Sciences Exactes et Naturelles, Vol. vii., No. 4, 1872.

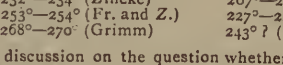
In addition to original papers relating to mathematics, natural history, and experimental physiology, this number contains the following original memoirs relating to chemistry and collateral sciences:—

The Physometer, a New Instrument for the purpose of Determining Variable Volumes of Air or other Substances, and more particularly the so-called Swimming-Bladder of Fishes.—P. Harting.—The contents of this exhaustive monograph, illustrated by several engravings, not only detail the description of the physometer invented by the author, but also the history of the various opinions held by scientific men on the functions of the swimming-bladder of the fishes, and further, a series of minute experiments to illustrate the action of this organ, and of exhibiting to what applications the physometer may be employed.

Although not belonging to chemistry, we call attention to the following essay:—

Action of a Constant Electrical Current upon the Nervus Vagus (Pneumogastric Nerve).—F. C. Donders.

On Nonylic Acid (probably) Normal.—A. P. N. Franchimont and Th. Zincke.—The introduction to this essay contains, first, reference to the other researches of the authors connected with this subject, and, next, a *resumé* of the labours of others on nonylic, also known as pelargonic, acid, having been discovered in the distilled water obtained from the *Pelargonium roseum*. Nonylic acid, $C_9H_{18}O_2$, is obtained from octylic alcohol by a process described at length. The acid is a colourless, oleaginous liquid, boiling at from 253° to 255°; sp. gr. at 17·5°=0·9065; it is hardly soluble in water, solidifies at a low temperature, and melts again at 10°, but the acid obtained by decomposing the baryta salt thereof (an exceedingly pure acid) was found to solidify at 11·5, and to melt again at from 12° to 12·5. The authors describe, at great length, several of the salts of this acid, most of which are crystalline when obtained from their alcoholic solution. The methyl-nonylic and ethyl-nonylic ethers are also described; the formula of nonylic acid is quoted as follows:—



There is added to this memoir the following tabulated form:—

Names of the Acids.	Boiling-Point of the Acids.	Boiling-Point of the Ethylic Ethers.
Acetic	118° (Linnemann)	77° (Linnemann)
Propionic ..	140·6° ,,	98·8° ,,
Butyric	162·0° ,,	121° ,,
Valerianic ..	184° (Lieben and Rossi)	Not known.
Caproic	204·5°—205° ,,	166·5—167·5° (Fr. and Z.)
Heptylic ..	219°—222° (Schorlemmer) / 223°—224° (Franchimont)	187°—188° (Franchimont)
Octylic	232°—234° (Zincke)	207°—208° (Fr. and Z.)
Nonylic	253°—254° (Fr. and Z.)	227°—228°
Capric	268°—270° (Grimm)	243° ? (Fincker)

And, further, a discussion on the question whether the nonylic acid prepared by the authors is, or is not, identical with the pelargonic acid of older days. While there is, on careful comparison of the results of the older researches and analysis, every reason to believe that the acids alluded to are really identical, the authors prefer to leave this question until they have finished their investigation of the nonylic acid prepared from the essential oil of rue (*Ruta graveolens*).

Researches on the Liquid Emitted by the Larvæ of a Cimbex.—A. J. van Rossum.—In the introduction to this paper, the author communicates some entomological particulars relating to the larvæ of the *Tenthredinæ*, genus *Cimbex*, which, provided with small lateral apertures, emit through these, with comparatively great force, a coloured fluid to protect themselves from the attacks of ichneumons, birds, &c. This fluid, collected by the author from the living larvæ, has been chemically investigated, and found, while exhibiting a distinctly alkaline reaction, to be mainly a protein or albumenoid compound, which behaves with reagents very much like white of egg. As regards the nature of the colouring matter, it is probably chlorophyll, or some modification thereof. The liquid experimented with was that from the larvæ of *Cimbex connata* and *Cimbex sylvarum*. The author thinks that the fluid acts as a means of defence, more by reason of its viscosity than by reason of its weak alkalinity.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, November 14, 1872.

The only paper in this number collaterally relating to chemistry is—

Use of Tin-Foil instead of Paper for Covering Walls, and on the Process of Applying Colours to that Material.—Daniel and Co.—From the exhaustive account and directions here given, it appears that, for papering rooms, tin-foil offers great advantages, both as regards decoration and durability.

MEETINGS FOR THE WEEK.

MONDAY, Dec. 9th.—Royal Geographical 8.30.
—— Medical, 8.
TUESDAY, 10th.—London Institution, 4.
—— Civil Engineers, 8.
—— Photographic, 8.
WEDNESDAY, 11th.—Society of Arts, 8.
THURSDAY, 12th.—Royal, 8.30.
—— Royal Society Club, 6.
FRIDAY, 13th.—Philosophical Club, 6.
—— Astronomical, 8.
—— Quekett Club, 8.

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On Friday next, No. II.

Government Control of Telegraphs: Operators' Salaries.
International Telegraphy in Time of War.
General Eardley Wilmot on Telegraphy.
On Ohm's Law and Kirchhoff's Corollaries. By Robert Sabine, C.E. (With Four Woodcuts).
Sir Charles Wheatstone's Automatic System. (With Six Woodcuts).
Cable Signalling. By G. K. Winter, F.R.A.S.
M. Planté's New Secondary Battery. (With Two Woodcuts).
Improved Grove's Battery. By Horatio Yeates. (With Two Woodcuts).
Phenomena of Lightning. By Father Secchi.
Electrical Resistances. By Walter Hall.
Improved Form of Induction Coil.
Magnetic Energy. By M. Cazin.
Students' Column.—Proceedings of Societies.—Electrical Science in Foreign Journals.—Telegraph Share List.—City Notes.—Notes of Appointments in the Service and of Passing Events.—Register of New Patents, &c., &c.

London: Henry Gillman, Boy Court, Ludgate Hill, E.C.

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THE CHEMICAL NEWS.

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ON THE SULPHUROUS IMPURITY IN COAL-GAS.*

By A. VERNON HARCOURT, F.R.S., Sec. Chem. Soc.

The luminous flames we use to light our houses after sunset are all equally gas flames.

The gas which burns round the wick of a candle is formed by the action of heat on the grease of which the candle is made. The gas which burns over the wick of an oil lamp is formed by the action of heat on the oil. The gas which burns over a "gas-burner" is formed by the action of heat on coal.

By the heating of any of these substances many different kinds of gas are produced, some of which become liquids if they are allowed to cool, while others are permanently gaseous. In the case of candles and lamps, when the hot gas is burnt as fast as it is made, the uncondensable and the condensable are burnt alike, the latter contributing even more than the former to the luminosity of the flame. In the case of coal-gas, which is kept for many hours, and has often to travel along many miles of iron piping before it is burnt, only very little condensable gas reaches the burner. In this respect "gas" illumination is at a great disadvantage as compared with candles or lamps. To counterbalance this disadvantage gas must be produced from some substance which is much cheaper than grease or oil, and such a substance we have in coal. But coal, like all minerals obtained on the large scale, is mixed with small quantities of other substances, and, in particular, masses of coal always contain a greater or less proportion of a mineral known, according to its form, as pyrites or marcasite, composed of 8 parts of sulphur united with 7 of iron. When coal is heated, a part of the sulphur from this mineral unites with the carbon and hydrogen of the coal, and thus the illuminating gas formed from coal is contaminated with at least two sulphur compounds—carbon bisulphide and hydrogen sulphide. Such gas yields when it is burnt, in addition to water and carbon dioxide, sulphur dioxide produced by the burning of the sulphur. This gas has a well-known pungent smell; it acts on various colouring matters, and it is gradually changed in presence of air and moisture into a far more destructive substance, called hydrogen sulphate or oil of vitriol. Unlike sulphur dioxide, which is a gas and can be removed by ventilation, hydrogen sulphate is not volatile, and exercises a continued corrosive action upon organic materials or fabrics on which it is deposited. In a furnished room the leather bindings of books and coverings of furniture are especially liable to be injured thus; perhaps because this material, being a better conductor of heat than others which are used for the same purposes, is more bedewed after gas has been lighted in a room than they are, and also because it requires less often to be cleaned or renewed. Fortunately the conversion of sulphur dioxide into hydrogen sulphate takes place so slowly that in a room lighted with gas and well ventilated a very small part of the sulphur which gas is liable to contain remains in this destructive form. Fortunately, also, the quantity of sulphur which gas as at present manufactured is liable to contain is very small. In a room lighted with four gas-burners the volume of sulphur dioxide mixed with the atmosphere of the room in the course of an hour is about one-hundredth of a cubic foot. The amount actually present at any moment, if the room is fairly ventilated, is a small fraction of this volume. Nevertheless, it is possible, and even probable, that some injury, especially to the bindings of books, may in the course of years be caused under these circumstances; and it is desirable, with a view to avoiding any such injury, and also with a view to allaying the apprehension of it, that the proportion of sulphur compounds in coal-gas should be reduced as far as possible.

A ton of coal may contain about 30 lbs. of sulphur: it yields nearly 10,000 cubic feet of gas, and a considerable part of the sulphur contained in it is given off with the gas in combination with either carbon or hydrogen. Of these two elements, hydrogen claims by far the larger proportion, not less than 10 parts for 1 that is united with carbon. For the purification of gas from hydrogen sulphide, excellent methods are everywhere in use. The gas is passed through layers of slaked lime or of iron oxide, by either of which substances all the hydrogen sulphide is capable of being completely absorbed. But the smaller quantity of sulphur existing in the form of carbon bisulphide is not arrested by these agents, nor is there at present any material or process known by which it can be effectually removed.

When coal-gas which is pure from hydrogen sulphide is heated and tested again, it is found to contain this impurity, showing that some ingredients of the gas are capable of producing hydrogen sulphide by their mutual action. Hydrogen seems to have a much stronger affinity for sulphur than carbon has. One consequence of this difference is the unequal partition of the sulphur between the two elements in the gas retort. But this inequality does not reach its limit in the short time which elapses between the formation and cooling down of the gas; and accordingly, when foul gas (or gas which has not been purified from hydrogen sulphide) is further heated, the proportion of hydrogen sulphide in it is increased, and that of carbon bisulphide diminished. From a number of experiments in which foul gas was passed through an iron tube 3 inches in diameter, filled with iron turnings and heated for a length of about 2 feet to low redness, it appeared that the amount of carbon bisulphide could be so far reduced that the gas, after purification from hydrogen sulphide, contained 5 or 6 instead of 30 grains of sulphur in 100 cubic feet. The gas was driven through the heated tube at a rate of from 1 to 2 cubic feet a minute.

A somewhat greater reduction in the amount of sulphur is obtained by heating the gas after, instead of before, purification and purifying it a second time. If it is the case, as seems probable, that the sulphur present in coal-gas distributes itself when the gas is heated between the carbon and hydrogen in a ratio dependent upon the relative affinity for sulphur of the two elements, the proportion of carbon bisulphide to the total sulphur in the gas will be always the same when the composition of the gas is the same, and when it has been heated long enough for the establishment of an equilibrium. Accordingly we should expect the removal of sulphur, by the conversion of carbon bisulphide into hydrogen sulphide and the absorption of the latter, to be accomplished more effectually with gas from which the chief part of the sulphur had already been extracted. And this, as has already been stated, is found to be the case.

The nature of the chemical change which takes place when coal-gas is heated may be illustrated by passing hydrogen over the mouth of a tube containing carbon bisulphide, and thence through a piece of combustion tubing heated nearly to a red heat. The mixture of hydrogen and carbon bisulphide vapour has no action on a solution of lead acetate; but, after the application of heat, the gas which issues produces at once a black precipitate, proving that hydrogen sulphide has been formed. This change occurs readily with hydrogen which has been carefully dried; but the presence of moisture appears to promote it; and as coal-gas contains a quantity of aqueous vapour, much more than sufficient to react with the maximum amount of carbon bisulphide, it is possible that the formation of hydrogen sulphide when coal-gas is heated may be partly due to the intervention of moisture.

If clean iron nails are heated to redness in a glass tube,

* Read before the Royal Institution of Great Britain.

and coal-gas is passed slowly over them, a soft black carbonaceous deposit is formed, and the gas is deprived of a part of its carbon. If, however, the gas be passed through more rapidly, no such deposition takes place, although the time of contact of the gas with the heated surface is still sufficient to effect the conversion of the carbon bisulphide into hydrogen sulphide. In the latter case it may be presumed that no change occurs in the illuminating power of the gas. But to establish a point which is of capital importance, some direct observations were made on the illuminating power of gas thus treated. It was found with gas passing at the rate of 5 cubic feet an hour through a half-inch iron tube, heated for a length of 12 inches, that, when the heat did not exceed low redness, no change was observable. When the heat was raised to bright redness, there was a perceptible increase in the illuminating power.

If the process of heating coal-gas, in order to remove the sulphur contained in it, should be employed on the manufacturing scale, the rate of transmission of the gas through the heating apparatus would necessarily be such as to render any deposition of carbon very unlikely. But even where such deposition takes place, it is not necessarily accompanied by a diminution of the illuminating power.

An interesting experiment, from this point of view, is the decomposition of marsh-gas by the electric spark. When a stream of sparks from a Ruhmkorff coil is transmitted between the ends of platinum wires through a small quantity of marsh-gas enclosed in a glass tube over mercury, the gas gradually expands. In about ten minutes it is nearly doubled, and at the same time a black deposit appears on the tube, in the neighbourhood of the wires. Here the intense heat applied has effected an almost complete decomposition of the hydrocarbon into its elements. But at the same time there is found a small quantity of some more condensed hydrocarbon, probably acetylene. On expelling the gas through a jet attached to the upper end of the tube, and burning it, the flame is seen to be much more luminous than that of marsh-gas itself. The fact of which this experiment gives a striking illustration is that the illuminating power of gas depends much more upon the nature of the hydrocarbons it contains than upon the total amount of carbon. How great would be the gain to the manufacturers of coal-gas, if such an operation as this were possible on the large scale, by which the volume of gas is doubled, and its illuminating power, at the same time, greatly increased!

As far as chemistry is concerned, the simple operation of heating gas appears to offer the means of a sufficiently perfect purification. The construction of a suitable system of iron pipes for heating the gas, and the best mode of obtaining and applying heat, is a problem for the engineer. On the scale on which gas is manufactured, all the apparatus for dealing with it must be of a magnitude to which it is difficult to pass, even in imagination, from the small scale of laboratory experiments; but, otherwise, the problem does not appear to be one of any peculiar difficulty. It may perhaps be found possible to employ some of the waste heat of the retort-house for this purpose, and thus to effect the required purification without much increasing the consumption of fuel.

PASSAGE OF HEAT-RAYS THROUGH INCLINED DIATHERMANOUS PLATES.

In a recent number of Poggendorff's *Annalen* Prof. Knoblauch describes some careful researches on this subject, of which we propose here to give the chief results.

The first part of his paper treats of the influence of polarisation on the phenomenon; the second, that of the nature of the plate as regards absorption.

The sun's rays were directed horizontally, by means of a heliostat, into a dark room, where they met the plate (which was movable about a vertical axis), and, passing through it, affected a thermo-pile and galvanometer. In entering the chamber the rays passed through a Nicol's prism. The plates first employed were of colourless plate-glass, one of them 1 m.m. thick, the other 2·5 m.m. (The material of the former, in considerable thickness, looked slightly blue,—that of the latter slightly yellow).

The rays were first allowed to meet the surface at a right angle, and a certain deflection of the needle (15°, 10°, or 9°) was obtained by adjustment of a slit. The plate was next turned on its axis to a different angle.

In previous experiments with polarised heat-rays the maximum quantity of heat was found to be transmitted through diathermanous plates, when the planes of polarisation and refraction coincided, or crossed at right angles.

From the first table in the paper before us it appears (*first case*) that with the plane of polarisation horizontal, and coinciding with the refraction-plane, the quantity of heat transmitted *diminished* as the angle of incidence, or the number of plates, was increased.

On the other hand (*second case*), with the planes of polarisation and refraction crossing at right angles, the heat transmitted *increased* in quantity with increased angle of incidence and number of plates, till the angle 55° was reached (the so-called angle of polarisation); then there was gradual decrease.

For example, in the first case, when one plate was turned from 0° to 55°, the needle moved from 15° to 12°; when eight plates were so turned, it moved from 15° to 7·5°. In the second case, on a like motion of one plate, the deflection was increased from 15° to 17°; of eight plates, from 15° to 23·46°.

The decrease which took place in both cases after 55° was much greater in the first case than in the second.

Further, even at 60° inclination of plate in the second case, the heat produced a deflection of 16·62° for one plate, and 22·72° for eight plates, as compared with 15° when the angle of incidence was 0°.

These results were compared with others which were obtained after placing the principal section of the Nicol at 45°, instead of vertically or horizontally, the rays in this case being taken as corresponding to unpolarised rays. With this arrangement, the absorption of the glass was little affected by increasing the inclination or the number of plates, no change appearing till 35° inclination with a plate of one kind of glass, nor till 55° with one of the other; thereafter a slight decrease. With eight plates of either kind the deflection increased somewhat till 45° or 55°, after which there was decrease. Thus we have, in the present arrangement, a beginning of that which reached its maximum when the polarisation and refraction-planes crossed. The reason why this case, while between the first two, shows the approximation now referred to, is, according to Prof. Knoblauch, that the mere passage through the inclined plates calls forth a polarisation (increasingly imperfect) the plane of which is at right angles to the plane of refraction.

Another point may here be noticed. The coefficients of absorption, corresponding to changes of angle in the plate above 55° where the Nicol's principal section was vertical (and hence the two above-mentioned planes coincided), stood further apart in the case of one plate (*e.g.*, 25 : 33) than where there were several plates (53 : 67). With the principal section horizontal, on the other hand, they were nearer to each other with one plate (4 : 9) than with several (11 : 56).

To determine how, with the principal section of the Nicol horizontal (and the two planes crossing), the increased transmission of heat took place in a substance showing very little absorption of heat-rays, Prof. Knoblauch made some experiments with sylvin and rock-salt. The sylvin had a thickness of 4 m.m. (the least possible), and this was found to give too much absorption, the quantities of heat transmitted being less than with thin glass plates.

The increase of transmission, which with the glass

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PRELIMINARY NOTICE

ON THE IODO-DERIVATIVES OF THE ORCINS.

By JOHN STENHOUSE, LL.D., F.R.S.

In 1864 (*Journ. Chem. Soc.*, vol. xvii., p. 327) I published an account of teriod-orcin, obtained by the action of iodine protochloride on an aqueous solution of orcin, but I found I was unable by this process to obtain any other iodo-derivative of orcin.

Monoiod-orcin, $C_7H_7IO_2$.—When an ethereal solution containing a molecule of orcin and one of iodine is agitated with dry precipitated mercuric oxide, the colour rapidly disappears and an iod-orcin is formed. On distilling off the ether, and extracting the residue with hot benzol, the iod-orcin separates in the crystalline state on cooling. In this reaction, powdered lead oxide (litharge) may be advantageously substituted for the mercuric oxide, since the lead oxide produced is not dissolved when the residue is extracted with benzol. Two or three alternate crystallisations from benzol and from water suffice to render the iodide pure; but, if mercuric oxide has been used, it is advisable to employ a dilute solution of potassium iodide for the first crystallisation, to prevent the mercuric iodide crystallising out along with the iod-orcin.

Monoiod-orcin, as thus prepared, is a colourless crystalline substance, which melts at about 86°, and decomposes, with evolution of iodine vapours, when heated more strongly. Gently heated with concentrated sulphuric acid, the substance is decomposed and iodine freely liberated. Iod-orcin is only slightly soluble in cold water, but readily in hot water. It is very soluble in ether and in hot alcohol; moderately soluble in benzol and in hot petroleum, crystallising out from the latter almost entirely on cooling; slightly soluble in carbon disulphide. It is quite destitute of the peculiar astringent sweet taste so characteristic of pure orcin.

Monoiodo-resorcin, $C_6H_5IO_2$.—This compound, prepared in a similar manner to the corresponding orcin compounds, is a colourless crystalline substance, closely resembling the iod-orcin in its general characters, but much more soluble in water.

When the monoiod-orcins, in ethereal solution, are again treated with iodine and a metallic oxide, more of the hydrogen is replaced, producing the higher iodo-compounds; these I am at present investigating, and hope, by pushing the action to the fullest extent, to obtain pentaiodo-orcins corresponding to the chlorine and bromine derivatives, of which I have already published an account.

ON THE PRESENT POSITION OF SCIENCE IN RELATION TO THE BRITISH GOVERNMENT.*

By G. GORE, F.R.S.

It is a matter of great importance to this nation, and of special importance to the scientific men of this country, to clearly realise the position which science at present occupies in relation to our Government. That position will probably be further brought to light by the evidence which is now being given by our leading scientific men before the "Royal Commission for the Advancement of Science."

For many years science has been of immense practical value to us; it has, by means of its discoveries, originated all our telegraphs, railways, steamships, gas lighting, photography, electro-plating, artillery, and nearly all our great manufactures. It has led to the expenditure of hundreds of millions of pounds upon these and other matters, and at the present time this nation largely exists upon the applied results of scientific discovery. There was a period when we did not possess such evidence of the great value of science; but that time has passed away, and our governing men have had abundant proof of the national importance of scientific discovery, and of the essential dependence of the welfare of this country upon scientific research. It is upon these grounds, therefore, that our Governments are expected to consider their duty with regard to science.

Scientific discovery and research (as distinguished from invention) is *national* work, and it is a duty of the State to provide and pay for it, because the results of it are of immense value, and indispensable to the nation; also, because nearly the whole benefit of it goes to the nation, and scarcely any to the discoverer; and because there exists no other means by which scientific investigators can be paid for their labours.

It is barely credible that, whilst the non-productive classes of the community are justly protected in the enjoyment of titles and material wealth which they have not earned, the greatest scientific workers and benefactors of the nation receive actually no payment for their labours, and the nation in general, and the non-productive classes in particular, reap the pecuniary benefit. The chief benefits of science go to the enrichment of the great manufacturers and capitalists, and finally and permanently to the great landowners, by increasing the value of land. It does not add to the dignity of one class of persons that they should be living largely upon the unpaid labours of another class; and it tends to produce evil feelings between them.

It may be objected that scientific men ought either to sell their discoveries or protect them by means of patents. Neither of these courses are possible. Scientific discoveries, although of such great value, are not saleable things; because they have not been converted by the process of invention into practical shapes, and because they cannot be protected by patent. They cannot be protected, because they are so universal in their applications. A single discovery often originates more than one hundred inventions, as may be readily seen by the number of patents taken out for the application of a single discovered substance, such as gutta-percha or india-rubber. No man could have secured to himself the discovery of the chemical action of light, because of the great number of persons who would have applied it to useful purposes, and used the applications; to claim such a discovery would be a considerable approach towards monopolising the benefit of light itself.

It is only when a discovery has been adapted to some particular use in some special way, by means of invention, that its discoverer can protect a part of it by patent, and reap any pecuniary benefit; and to protect it completely would require it to be applied to all the practical uses of which it is capable, which could only be effected by means of many inventions. Further, the faculties of invention and discovery are rarely united in one man, and it requires a higher quality of mental power to make a discovery, than to apply that discovery to useful purposes by means of invention.

Scientific discoveries, being of universal utility, like the light, the land, the air we breathe, belong, by their very nature, to all the nation. From the moment that a discovery is published, it gets copied into all the scientific publications; it immediately becomes used by teachers for the purposes of instruction, and by inventors generally as a basis for patentable inventions; and in these ways it becomes at once national property, and no law can prevent it.

* Read before the Social Science Association, Plymouth, 1872.

It may also be objected that scientific men should not make discoveries if there is no payment for such labour. Many men are impelled by a natural desire to do good, irrespective of payment, whilst others are equally selfish, and live upon the labours of their fellow-creatures; and if such men did not make discoveries we should be without most of the luxuries, comforts, and conveniences of life. Every man who benefits his fellow-men, or labours for the good of the nation, is entitled to means of existence, and the only just course is to provide for his support.

It may further be objected that scientific men should keep their discoveries secret; but that would be worse than useless, because discoveries cost great skill and labour, and when published are of great value to mankind.

The general aspect in which science is viewed by many persons in this country is that of a refined intellectual pursuit, which may be encouraged and honoured for the purpose of maintaining the tone of society, but which must on all occasions be considered as secondary to the more *apparently* practical requirements of national life, and be sacrificed to them; but this is a superficial idea, and has its origin in the low state of scientific knowledge. Science is eminently practical; scientific discovery lies at the very basis of national progress, and is the origin of many of the practical advantages of civilised life. The idea of men being able to honour demonstrable truth is simply an ignorant conceit. Science cannot be honoured by anyone, and the question is, not whether the State shall encourage science as a refined intellectual occupation, but whether our governments will consider the welfare of the nation in its relation to science.

One of the first duties of a Government is to protect its subjects in the enjoyment of their property; but as no law can reserve to discoverers the fruits of their industry, and as scientific discovery is national work, it is clearly a duty of the state to pay for it. It is as certainly its duty to provide and pay for original research as for its military and naval establishments; because the development of the industry and warlike appliances of the nation is quite as important as the maintenance of its means of defence and aggression. The power that has brought into existence new industries is certainly as valuable to this nation as the means of preserving to us the possession of them afterwards; and we must not forget that our great cannon, explosive missiles, and armour-plated ships would not have existed but for the discoveries of scientific men.

Since the last Paris Exhibition an opinion has gradually spread that, in consequence of our neglect of science, foreign nations are supplanting England in her manufactures; but whether this opinion is or is not correct, there can be no doubt that national superiority can only be maintained by being first in the race, and that as a matter of prudence we should not neglect any precaution which is necessary to the welfare of the nation.

The very foundations of science in this country are rapidly being destroyed by the neglect of science by our Governments, and by those who have derived the greatest amount of benefit from it. Original discovery is the basis of all scientificp rogress. Great discoverers are rare, and the loss of a few of them is a national calamity. The majority of our most able investigators have ceased to make researches because the State does not pay for such labour. Several, also, of our most eminent discoverers have died, and others have not arisen to take their places. The discoveries in chemistry by British chemists, published in the *Journal of the Chemical Society*, have diminished almost to zero; whilst those of foreign chemists have so increased that the journal referred to is almost filled with them. But few first-class investigators are making original researches in this country, and we are rapidly becoming dependent for our progress in scientific arts and manufactures upon knowledge supplied to us by foreign nations.

In all directions, wherever we examine the state of knowledge of science amongst the governing men of this country, we find it very defective, and attended by results seriously injurious to the welfare of the nation. Gentlemen who are comparatively ignorant of science are appointed by our Governments to decide scientific questions. Only recently (May 21st, 1872), a memorial of the British Association, signed by the eminent president, Sir William Thomson, was sent to the Lords of the Treasury, applying for a sum of £150, to continue a series of observations on the tides, upon which the Association had already expended £600 from its own resources, and which was essential to a more complete knowledge of the tides, and consequently to the greater safety of our navy. The reply to this application was most civil; but, putting upon it the most charitable construction, it exhibited a degree of ignorance of the national value of science most painful to contemplate. The reply stated "that their lordships have given their anxious attention to the memorial, and that they are fully sensible of the interesting nature of such investigations; but that they feel that, if they acceded to this request, it would be impossible to refuse to contribute towards the numerous other objects which men of eminence may desire to treat scientifically. Their lordships must, therefore, though with regret, decline to make a promise of assistance towards the present object out of public funds."

Here was a subject of great importance to the national welfare, and which it was the duty of the State, and not that of the British Association, wholly to pay for, treated as if it was only an investigation of an "interesting nature," "which men of eminence may desire to treat scientifically."

Their lordships were apparently not aware that ignorance of the course and height of tides often leads to shipwrecks, and that their refusal of £150 might lead to the loss of some valuable ship; tbey seemed to have forgotten that the loss of the ill-fated *Captain* was due to neglect of science. Such a want of knowledge in any private appointment would be a sufficient reason to remove from his post the responsible person. It is difficult to believe that the Government of a maritime country should be so ignorant of science as to decline to make even a promise of assistance out of the public funds of the small sum of £150 for such an important purpose, whilst it expends immense sums of money upon ships. Their lordships were manifestly unable to appreciate the importance of the application, or to perceive the duty of the State to pay for such labours; and, instead of acting upon the opinion of disinterested men, of the highest eminence in the subject, declined to accede to the request.

Gentlemen who are but little acquainted with science are also appointed by our Government to direct eminent scientific men in scientific matters, and the results, as might be expected, are most unsatisfactory. A recent melancholy instance of this kind, which has degraded our Government in the opinion of other nations, and of all well-instructed persons, is fresh in the memory of the public. Mr. Ayrton, the Chief Commissioner of Works, was placed in authority over the eminent botanist, Dr. Hooker, at Kew Gardens, and presumed to interfere with the management of the hothouses under Dr. Hooker's care. There is scarcely a scientific man in this country who has not frequently suffered from similar ignorant misdirection, but the circumstances have not happened to become public. If governing men possessing the requisite knowledge of science for such posts cannot be obtained, it is clear that those appointed should not be entrusted with the power, nor burthened with the responsibility of directing subjects they do not understand, and the course indicated in such a case is a division of labour, making the scientific officers much more independent than they hitherto have been.

The origin of all these evils lies largely in the defective state of scientific instruction at our old universities and great public schools. Our governing men, having been chiefly educated at those institutions, have been but little instructed in science. In addition to this, science has advanced so greatly during the last few years that it has

become an immense department of national life, requiring a special education to understand, and has left our old institutions behind.

The heads of colleges and the head masters of nearly all our grammar schools, having also acquired their learning at our old universities, have been but little, or not at all, educated in science, and in consequence of this, scientific instruction is in a low state throughout nearly the whole scholastic system of the country. Further, the "Endowed Schools Commission," now pursuing its labours, recommends "that all lecturers and teachers" in the various Government schools of this country "shall be appointed and dismissed by the head masters," and that "the said head masters shall have under their control the choice of books, and the method of teaching" in those schools. A result of these provisions will be that the system of appointing gentlemen comparatively ignorant of science to direct teachers of science will be continued, and scientific instruction will continue to be degraded in the grammar schools of this country. These very proposals prove that the gentlemen who made them had not been well instructed in science.

It is manifest that the only foundation of a reliable judgment in scientific affairs is a good knowledge of science, and this can only be obtained by long-continued study and experience. It is also clear that the practice in this country of appointing gentlemen comparatively ignorant of science to legislate for it, and to direct scientific men in Government offices and public schools, is one of the most effectual that could be devised for retarding the progress of the nation in all those matters which depend upon science. If scientific men are to be legislated for and directed, justice requires that it should be by men possessed of adequate scientific knowledge.

To partly remedy this unsatisfactory state of things, we require a State Minister of Science, possessed of scientific knowledge and good administrative ability; a Scientific Council, to advise the Government in all important matters relating to science; and State laboratories for pure scientific research.

The funds for providing State laboratories already exist; the sum of nearly £600,000 has accumulated in the form of fees received by Government for the granting of patents for inventions; and as the discoveries made by scientific men form the materials by means of which those inventions were made, the money thus accumulated may be justly claimed by scientific discoverers as a source from which their labours should be remunerated by the State.

As long as scientific men continue at their own expense to do scientific work which ought to be paid for by the State, so long will the governing and richer classes of this country, impelled by the selfishness which pervades them in common with nearly all mankind, and unenlightened by knowledge of science, neglect the duty of paying for original research, and reap the chief benefits of such labours.

The time has arrived when this great national evil should be made known, and put an end to; and our men of science should present a memorial to our Government, claiming as a matter of justice, necessary for the nation's welfare, that the accumulated fees from patents should be applied to the establishment of a Scientific Department of the State, the erection of State laboratories, and the payment of discoverers for the national work of research.

Should our Government continue to neglect these just claims, and disregard the evidence collected by the "Royal Commission for the Advancement of Science," the decline of original scientific research, which has already commenced, will continue. The probable results of this will be, inventions will become scarce; new trades will not be developed; improvements in agriculture, arts, manufactures, means of defence, and other important matters, will decline; the value of houses and land will diminish; and our commerce will pass into the hands of other nations.

ON THE HISTORY OF OZONE.*

By Professor ODLING, F.R.S.

The most important points in the history of ozone are the following:—I. Its recognition as a distinct variety of matter or substance, by Schönbein in 1840. II. An inquiry into its nature, made by Marignac in 1845, whereby it was established that the action of ozone on various substances results simply in their oxidation. III. The evidence of different kinds, accumulated by many observers during a period extending from 1845 to 1863, that the matter of ozone is identical with the matter of oxygen. IV. The demonstration by Andrews and Tait in 1860, that ozone is a condensed form of oxygen. V. The recognition by Andrews and Tait in 1860, and interpretation by the speaker in 1861, of the singular fact that, in certain cases, the removal of its constituent ozone from a mixture of ozone and oxygen in unattended by any alteration in the volume of the gas, notwithstanding the considerable oxidation effected by it. VI. The study of the quantitative reactions of ozone by Brodie in 1872; and his establishment of the relationship of ozone to ordinary oxygen, in corroboration of some less exact results obtained by Soret in 1865, as also of a suggestion made by the speaker in 1861.

I.

Ozone was discovered by Schönbein, in 1840, when experimenting with the then newly-invented battery of Sir Wm. Grove,—an instrument still recognised as yielding a current superior, in respect of joint quantity and intensity, to the current yielded by any other electromotor available for general use. Ozone was recognised by Schönbein successively as a minute constituent of the oxygen gas resulting from the electrolysis of water effected by a current of high tension; as a minute constituent of air or oxygen through which electric discharges have taken place; and as a minute constituent of air in which moist phosphorus has been undergoing slow oxidation. To Schönbein then is due the great merit of recognising ozone as a distinct form of matter, having an identity of its own by whatsoever means prepared—as also the merit of discovering the most important means for the production of ozone, and of establishing its principal properties and reactions.

The general properties of ozone are those of an active oxygenant. Thus, like chlorine and peroxide of nitrogen, it bleaches colouring matters, corrodes fabrics, tarnishes or otherwise attacks metals, and liberates iodine from iodide of potassium. Its special properties are its characteristic pungent odour, its destructibility by a moderate heat, and its non-manifestation of any acidulous reaction.

II.

The nature of ozone was at first the subject of much speculation, Schönbein inclining to the view that it was a new elementary body, and a component of nitrogen. But in 1845, Marignac, in a series of most exact experiments, made partly in association with De la Rive, brought the question as to the nature of ozone within a very narrow compass. The experiments of these investigators, in which they established, among other points, that by exposure to the action of ozone, moist silver was converted simply into oxide of silver, and iodide of potassium into its oxidised form of iodate of potash, were susceptible only of one or other of two interpretations—either the interpretation which they themselves put on their results, that the matter of ozone is identical with the matter of oxygen—or, else the interpretation put on their results by Schönbein, that ozone is constituted of oxygen *plus* the elements of water, or in other words, that it is a peroxide of hydrogen. For a long time, experiment seemed quite incompetent to decide between these two views—oppposite conclusions being arrived at almost alternately by the

* Read before the Royal Institution of Great Britain.

different investigators engaged on the inquiry. Corroboration, however, if any were needed, of the fact that ozone is really formed from oxygen itself with or without water, and not from any trace of nitrogen or other foreign matter that might possibly be present, was afforded by a remarkable experiment conducted by Fremy and Becquerel in 1853, being, indeed, the first recorded quantitative experiment made with ozone. By passing a long series of electric discharges through a given volume of oxygen standing over an aqueous solution of iodide of potassium, MM. Fremy and Becquerel succeeded in causing the whole of this oxygen to assume the form of ozone; as was shown by its ultimate complete absorption by the solution, with correlative liberation of iodine from the dissolved iodide of potassium.

The difficulty experienced in those early days of making out the real nature of ozone—of ascertaining whether it is a form of oxygen or a peroxide of hydrogen—depended mainly on the very small degree to which it was then possible to charge air or oxygen with the ozone to be examined, and on the necessity for the exclusive employment in the investigation of apparatus in which neither metal nor organic matter was present for the ozone to react with. The apparatus had consequently to be constructed entirely of glass, and all the junctions to be made before the blowpipe or by grinding. Now-a-days, by improvements in the methods of conducting the processes of electrisation and electrolysis, it is possible to charge oxygen with ozone in very considerable proportion; while by means of paraffin, a substance on which ozone is without recognisable action, junctions of the glass apparatus employed may be made and unmade with the greatest facility.

III.

Assuming the ozone furnished by the three principal processes for its production to be one and the same substance, it was not until the year 1863 that the absolute freedom of ozone from any proportion of hydrogen was so definitely established as not to allow of any further question. In this year, Soret showed that although ozonised oxygen obtained by electrolysis, after having been desiccated as thoroughly as possible, frequently yielded some water as a product of its decomposition by heat, yet that when certain precautions were taken, and certain sources of error in the production and collection of the electrolytic oxygen were recognised and avoided, a uniformly negative result was obtained, and not a trace of moisture or other compound of hydrogen resulted from the decomposition by heat of the ozone present in the oxygen.

This conclusion of Soret's was confirmatory both of the previous result of Andrews with regard also to electrolytically obtained ozone, and of the yet earlier result of Schönbein himself with regard to the ozone obtained by the slow oxidation of moist phosphorus. For in opposition to the view enunciated first by himself, and in seeming discrepancy with the undoubted fact that for the production of ozone by means of phosphorus the presence of moisture is essential, Schönbein, in 1849, showed by repeated experiment, that when ordinary air in quantities of several hundred litres, ozonised as strongly as possible by its passage over moist phosphorus, was transmitted first through a desiccating tube, then through a tube heated to 400°, so as to effect the destruction of the ozone present, and finally through another desiccating tube to absorb any moisture that might result from the destruction of the ozone, this last desiccating tube did not show, by an increase of weight or other change, any absorption of moisture whatever, notwithstanding the largeness of the absolute quantity of ozone destroyed in the experiment. From this time forth, Schönbein abandoned the notion of hydrogen being a constituent of ozone; and while making a valid distinction between his own view and that of Marignac and De la Rive, admitted with them that the matter of ozone is identical with the matter of oxygen. These last-named investigators, in their research already referred to (1845), showed that perfectly dry oxygen, submitted to the influence of electric discharges, experienced an alteration of character, whereby it acquired the property of liberating iodine from moist iodide of potassium,—a result afterwards confirmed by Fremy and Becquerel. But they did not regard this alteration of character as due to the formation in small proportion of a new substance within the mass of oxygen, but rather to the assumption by the mass of oyxgen of a peculiar electric condition. Moreover, the fact of dry oxygen being capable of some modification by the action of electric discharges, coupled with the fact of the inability of the so modified oxygen to act upon iodide of potassium save in the presence of water, was not inconsistent with the notion of this modified oxygen having to unite with water in order to produce a compound identical with the ozone obtained immediately from moist or watery reagents. That the effect of electrical discharges, and more particularly of the silent discharge, on perfectly dry oxygen, is really to convert a small proportion of this oxygen into ozone identical with that furnished by electrolysis, and capable of acting upon certain substances, as mercury and iodine, when in the dry state, and on certain other substances, as iodide of potassium and metallic silver, only when in the moist state, was first put beyond question by Andrews and Tait, in a research next to be considered.

IV.

In the spring of 1860, Dr. Andrews and Professor Tait made a joint communication to the Royal Society on the volumetric relations of ozone. The primary object of this research was to ascertain whether any, and if so what, alteration of volume took place in the conversion of a given quantity of oxygen into ozone. They thus attacked the problem from an entirely new point of view, and, with admirably directed pains and skill, succeeded in making probably the most important contribution hitherto made to an exact knowledge of the nature of the ozone. In their experiments, a quantity of perfectly pure and dry oxygen, contained in a straight glass tube with a pressure-gauge appendix, was ozonised by means of the silent electric discharge passed through the gas for some time. Coincidently with the passage of the silent discharge through it, the quantity of gas contained in the glass tube was observed to undergo a marked contraction in volume. This contraction proceeded at first rapidly, but afterwards more slowly, till it attained a limit which, in one of their experiments, was estimated at one-twelfth the original volume of the gas. And as whenever the gas, contracted in this manner, was examined, it was found to be proportionately ozonic, the general fact was established that the production of ozone from ordinary oxygen is attended with a contraction in volume. The converse result was also obtained. It was found that when oxygen, contracted by the passage of the electric discharge, was exposed for a short time to the temperature of 270°—300°, it was restored to its original volume. And as whenever the gas, re-expanded in this manner, was examined, it was found to be free from ozone, the general fact was established that the conversion of ozone into ordinary oxygen is attended with an expansion in volume. And this alternate contraction of a given quantity of oxygen by exposure to prolonged electrisation, with production of ozone, and re-expansion of the gas to its original volume by exposure to a temporary heat, with destruction of ozone, could be repeated an indefinite number of times. Now the only possible conclusion to be drawn from these experiments would appear to be that, the matter of ozone being identical with the matter of oxygen, ozone is oxygen in a denser form,—that is to say, in the form of a more complex unit. Some years afterwards, this conclusion was confirmed in a very interesting manner by Professor Tyndall, in the case of ozone obtained electrolytically. He found that the absorptivity for radiant heat of electrolytically obtained oxygen, when rich in ozone, was upwards of a hundred times greater than that of ordinary oxygen—a result indicating ozone to have a more complex molecular constitution, and consequently a greater density, than

ordinary oxygen. Moreover, after this same electrolytically obtained and richly ozonic oxygen had been subjected to the action of heat, so as to have its ozonic character destroyed, it then exhibited merely the absorptivity for heat of ordinary oxygen,—the observed absorptivity not going at all beyond that of ordinary oxygen, as would have been the case if the ozone originally present in the electrolytic gas had been decomposed into ordinary oxygen and aqueous vapour.

Referring to the statement already made, that in Messrs. Andrews and Tait's experiments, the oxygen gas, more or less contracted by the electric discharge, was found to be proportionately ozonic, this point was ascertained in the following way:—A small thin glass bulb, containing a solution of iodide of potassium, was introduced into the oxygen-holding tube, prior to its being filled with the gas; which, after having been more or less contracted by the process of electrisation, was next submitted to the action of the solution, released on the breaking, effected by concussion, of the small bulb wherein it was contained. And on estimating the quantity of iodine set free from the iodide of potassium solution by its reaction with the contracted gas, it was found to be the exact chemical equivalent of a weight of oxygen equal in volume to the amount of contraction which the original gas had experienced during the process of electrisation; so that if in the process of electrisation, there had been 1, 2, or 3 c.c. of contraction, the quantity of iodine liberated was chemically equivalent to the weight of 1, 2, or 3 c.c. of oxygen; whence it results that to ascertain the iodine-titre of the ozonised gas is to learn the contraction of the original gas effected by its electrisation, or the correlative expansion of the electrised gas effected by its exposure to heat. In the case also of electrolytically obtained ozonised oxygen, it was shown firstly by Andrews and Tait, and subsequently by Soret, that the iodine-titre of the gas is the measure of its expansion by heat, consequent on the conversion of its constituent ozone into ordinary oxygen.

(To be continued.)

RESEARCHES ON THE PART WHICH SULPHUROUS ACID PLAYS WHEN EMPLOYED FOR THE SACCHARIFICATION AND SUBSEQUENT ALCOHOLISATION OF GRAIN,

ACCORDING TO A NEW METHOD.

By V. HEMILIAN and N. MELNIKOFF.

During the last few years, a process has been introduced in the distilleries of Russia and Southern Germany, Bohemia, and other portions of the Austro-Hungarian Empire, which is considered by practical distillers to increase the yield of alcohol obtainable from grain, including maize, and which consists in the use of a weak solution of sulphurous acid when applied during the diastatic saccharification.

The raw grain and malt, previously ground to a fine powder, are macerated for from five to six hours in a cold solution of sulphurous acid, after which the mixture is heated to from 70° to 75°, and treated as usual. While there is no doubt that this practice is really good, the action of sulphurous acid on the substances capable of yielding alcohol has never been scientifically elucidated; we have made researches relative to this action, and here publish the principal results of our experiments.

In the first place, we have found, by a series of experiments, that sulphurous and other acids, employed in small quantities in practice, have the effect of very perceptibly diminishing the saccharifiant power of diastase, and, as a consequence of the application of the new method of saccharification, the action of a portion of the malt employed is rendered useless; but, on the other hand, our experiments have proved that sulphurous acid, applied in quantities to be hereafter indicated, renders the starch of the meal, when macerated in it for a long time, more fit for conversion into glucose. It is probable that suphurous acid, during the process of maceration, dissolves slowly the gluten and other albumenoid substances which envelope the starch in the meal, and thus the immediate contact of the starch granules with the solution of the diastase is promoted during the saccharification.

The effect produced by the action of the sulphurous acid consists, therefore, in the difference of the two opposite actions, one of which is injurious to alcoholisation, by decreasing the saccharifiant power of malt, while the other favours a more complete interversion of the starch of the substances employed. This difference, which determines the increase in the quantity of glucose, depends directly on the duration of the cold maceration, and on the quantity of sulphurous acid employed. The largest quantity of glucose is obtained by causing the cold maceration to continue for five or six hours with a solution containing from 0·1 to 0·13 per cent of the quantity of malt and meal used.

When the duration of the cold maceration is prolonged, and the quantity of sulphurous acid diminished, the quantity of glucose obtained is increased to its maximum. When the maceration in cold water, without sulphurous acid, is continued for eighteen hours, the result is equal to that obtained by the use of macerating with cold sulphurous acid solution; but maceration in cold water only is sure to bring on acidification and incipient putrefaction, which is not the case when sulphurous acid is present. If, on the other hand, the quantity of sulphurous acid is increased, and the time of cold maceration decreased, the quantity of glucose obtained rapidly decreases, because the injurious influence of the sulphurous acid upon diastase then begins to predominate over its favourable action upon the meal.

The increase in the yield of glucose, under the action of sulphurous acid and the most favourable conditions, is found to vary from 2 to 3 per cent of the weight of the grain employed. No sulphuric acid is formed during the cold maceration alluded to; the sulphurous acid forms, with the macerated materials, combinations from which, by the application of mineral acids, the sulphurous acid is set free without simultaneous precipitation of sulphur, so that no formation of hyposulphites takes place. The colouring matter of malt is, moreover, destroyed by the cold maceration with sulphurous acid; and, since we have found that the combinations formed by sulphurous acid during the cold maceration do not perceptibly injure the saccharifiant property of diastase, we propose the following modification in the application of this method. The meal only, without malt, is macerated in the cold with the solution of sulphurous acid of the strength above mentioned, and then heated to 50°, so as to volatilise any free sulphurous acid. The malt is next added, and the mixture, being all the time well stirred, is heated to from 70° 75°, these temperatures being best suited for saccharification. As regards the action of sulphurous acid upon the process of fermentation, comparative experiments have proved that this acid, in free state, even in so small a quantity as 0·2 per cent of the sugar, very perceptibly hinders the alcoholic fermentation which is rendered very slow, while the combinations formed by the sulphurous acid during the maceration, do not at all effect the ordinary course of the fermentation, which continues regularly until all the glucose is spent. During the fermentation of the wort obtained by the new method, and application of sulphurous acid, sulphuretted hydrogen is evolved in small quantity mixed with carbonic acid, while, in the fermenting liquid, sulphur compounds are formed which it would be very interesting to study more minutely. It is very important, for practical purposes, to know that, in wort fermenting under the conditions just mentioned, almost twice as little free acid is formed than in the fermentation of grain, malt, and meal under the ordinary conditions. The utility of the sulphurous acid process is

rendered very apparent when it is borne in mind that the free acids alluded to are formed at the expense of alcohol, while, at the same time, by the decrease of acids the nutritive value of the spent wash is rendered greater, and its consumption by cattle improved because it is rendered less injurious to health.—*Moniteur Scientifique.*

NOTE ON THE PURPLE OF CASSIUS.

By H. DEBRAY.

When a solution containing simultaneously protochloride and bichloride of tin, is poured into a very dilute solution of chloride of gold, the result is the formation of a brown-coloured fluid which is turbid when seen by reflected, and purple when seen by transmitted, light; while after a time a coloured precipitate is deposited in the liquid, which is the so-called purple of Cassius, and is—as is well known—the basis of all gold pigments employed in glass and porcelain staining for the purpose of producing rose, red, and violet colours.

The purple of Cassius may also be obtained under other conditions, and its composition varies with its mode of preparation, but is always such that it (the purple) may be represented as consisting of hydrated binoxide of tin and metallic gold in very finely divided state. The colour of this substance is the deeper the more gold it contains, but does not differ from the hues which the precipitation of gold alone can produce, so that Macquer, who first made this observation, viewed the purple of Cassius as a mixture of gold and hydrated binoxide of tin. Proust having observed that the purple dissolves in ammonia while still wet, and that on being triturated with mercury it yields no gold, the mixture hypothesis was generally abandoned, and the purple considered to be a chemical combination. The only rational mode of viewing the composition of this combination was to consider it to be a saline oxide, that is to say, a stannate of protoxide of tin and suboxide of gold, the latter containing a sufficient quantity of oxygen to convert the protoxide of tin into binoxide. This saline oxide might, moreover, be mixed with a variable proportion of stannic hydrate (*hydrate stannique*).

Since Proust's days, there have been many discussions and more researches on the constitution of the purple of Cassius. It would be impossible to give a *resumé* of these labours here; suffice it to say that no decisive arguments or any new view has been published in favour of either of the two hypotheses just alluded to, and which in my opinion are quite erroneous. I consider the purple of Cassius to be a lake of stannic (or metastannic) acid coloured by very minutely divided gold. The colouring matter of this lake has become insoluble in its usual solvent, mercury, just as the fast colours of the dyer resist the action of water in consequence of their union with the fibres of the woven fabrics, or with the mordants. The following results of experiments, and explanation of facts discovered by me will, I hope, completely justify this mode of viewing the purple of Cassius. I boil together a mixture of solutions of bichloride of tin and acetate of soda; the result is that binoxide of tin is precipitated. I next pour into the hot liquid a small quantity of chloride of gold, and then some oxalate of potassa; the result of which is that the gold is immediately reduced, and while only a small quantity of the metal is precipitated on the glass, the bulk of it is precipitated upon the oxide of tin, which thereby assumes the ordinary colour of the purple of Cassius. A perfectly similar colour can be produced with alumina by precipitating gold in a fluid which contains alumina in a state of suspension. For this purpose, I add to a solution of chloride of gold, saturated with acetate of soda, gelatinous alumina, and to the hot mixture I add gradually oxalate of potassa, whereby the gold is reduced. These two lakes having been kept suspended in water and shaken up in a closed strong glass vessel for several hours with mercury, have not lost their colour.

The ordinary method of preparing the purple of Cassius does not evidently differ from that just alluded to, except that the oxide and the colouring matter are precipitated together, by which means the beauty of the colour is undoubtedly increased, as well as its fastness towards mercury. It now remains to be explained how it is that this lake is soluble in ammonia. We know that oxide of tin is soluble in ammonia when precipitated at the ordinary temperature, so long as the oxide continues wet, and that it ceases to be soluble in ammonia under various conditions, as for instance, an elevation of temperature, and more particularly drying. The purple of Cassius loses its solubility in ammonia under precisely the same conditions, and hence it ought to be observed that the solution of purple of Cassius in ammonia (that solution being always turbid when viewed by reflected light) deposits slowly metallic gold, while the oxide of tin remains almost entirely in solution. This well-known fact is quite natural if the purple is a lake, but it is very difficult to explain if the gold is in the state of oxide, because the action of ammonia on the metallic oxides of the precious metals gives rise to the formation of more or less complex products, but never sets the metal free.

Mercadieu has observed that in the assay of the precious metals when silver which contains a small quantity of tin and of gold is dissolved in nitric acid, a substance is obtained very analogous to the purple of Cassius; and since gold is not oxidised by nitric acid, he inferred that the purple of Cassius contain the gold in the metallic state. Gay-Lussac having resumed these researches came to the same conclusion, but since this purple of Cassius so formed was not soluble in ammonia, it became necessary to demonstrate the identity, or at least the isomerism, of the two purples, Gay-Lussac feeling inclined to admit isomerism between the two substances. It can be proved that no other difference exists between the two purples except that due to the difference of conditions under which the binoxide of tin is formed. The oxide of tin obtained by the oxidation of that metal by the aid of heat is insoluble in ammonia, and the same holds good for the lake which it forms with gold. But if the ternary alloy of silver, gold, and tin is acted upon at a gentle heat, a purple is obtained which is soluble in ammonia, and I have found, by direct experiment, that the oxide of tin obtained under these conditions is soluble in that reagent.—*Comptes Rendus.*

THE CHEMICAL EQUIVALENT OF ETHER.*

By H. F. WALLING, Professor of Civil Engineering in Lafayette College.

Supposing the ether of space to be a gas, and therefore that it must have an atomic weight or chemical equivalent, I have thought that under the dynamic theory of gaseous elasticity this atomic weight could be computed in a simple manner whenever certain data should be sufficiently well determined, and that even now a tolerable approximation may be attained

In the equation

$$WV^2 = CT.$$

Let W represent the weight of an atom or molecule of any gas, V the velocity of an acoustic wave in this gas, and T any temperature reckoned from absolute zero in degrees which represent equal accessions of energy to the gaseous atoms or molecules. Then will C be constant, or nearly so, for all gases at temperatures considerably above that of their liquefaction.

To prove this we have first to show that V^2 changes in a constant ratio with T in any gas, W remaining constant.

Now the velocity of an acoustic wave is ascertained by calculating the velocity acquired in falling a distance

* Read before the American Association at Indianapolis.

equal to one-half the length of a homogeneous column of the gas having a sufficient height when vertically placed to produce by its own weight a pressure equal to that maintained in the gas. The velocity thus found is multiplied by a coefficient, constant for all gases and at all temperatures.† Since the height of the balancing column is, according to the law of Gay-Lussac, proportional to the absolute temperature, and since the square of the velocity acquired in falling is in proportion to the height of the fall, V^2 maintains a constant ratio to T, and C is constant so long as W remains unchanged.

Moreover, since the densities of different gases, at common temperatures and pressures are proportional to their atomic weight, the heights of their balancing columns, and therefore V^2 must be *inversely* proportioned to W. Hence the product WV^2 is the same for all gases having a common temperature, and hence C is constant for all gases at all temperatures considerably above liquefaction.

Assuming for hydrogen that W = 1, and taking the velocity of sound in that gas at zero centigrade to be 4164 feet per second, as determined by Dulong, we have

$$(4164)^2 W = 273C,$$

zero centigrade being equal to 273° of absolute temperature. Whence C = 63512.

A luminiferous wave is generally supposed to be similar in its nature to a sound wave. If this be true, the general equation with C as above determined will apply to the ethereal medium.

The velocity of light is, in round numbers, 1,000,000,000 feet per second, which gives—

$$(1{,}000{,}000{,}000)^2 W = 63512T,$$

in which T represents the temperature of the interplanetary spaces. Hopkins places it at 38·5° C., Fourier at −50°, and Pouillet at −142°.‡

The values of W calculated for ether with these values of T are as follows:—

T = −38·5° = 234·5° absolute temperature,
W = 0·000000000014893564.
T = −50° = 223° absolute temperature,
W = 0·000000000014163176.
T = −142° = 131° ab. temp., W = 0·000000000008320072.
Taking the mean of the estimated temperatures,
T = −77° = 196° ab. temp., W = 0·000000000012448352.

Comparing the values with the fraction—

$$\frac{1}{2^{36}} = \frac{1}{68719476736} = 0{\cdot}000000000014551912$$

it appears that the atomic weight of ether is probably equal to that of hydrogen after it has undergone not less than 36 or more than 37 successive halvings.

Perhaps an objection will be made to this conclusion that the transverse vibrations, which constitute light, indicate that their medium is solid rather than fluid, and therefore that the relations between its atomic weight and wave velocity is different from that of gases.

I have advanced the supposition in previous papers that the atoms of bodies, in consequence of their momenta and mutual attraction, fall into a linear arrangement; that the "elemental fibres" thus constituted intersect each other so as to occupy space in its three dimensions, forming the edges of imaginary cubes in gases; that the atoms being *non-impenetrable* traverse freely each line of fibre in both of its directions, tending to preserve equality of distances by mutual attractions, and the accelerations produced by temporary *huddlings*; and that longitudinal vibrations, along the fibre (condensations and rarefactions) in consequence of the mutual actions and reactions of intersecting fibres, are accompanied by transverse vibrations (undulations), which in ether constitute light, the *resultant* impulses being radial for the longitudinal and concentric for the transverse vibrations.

If such a hypothesis be found tenable, it will remove any objection to the above conclusion founded upon a supposed constitutional dissimilarity between ether and ordinary gases.

† This coefficient as found by experiment is $\sqrt{1{\cdot}42}$, and it represents the amount of acceleration which is produced by the disturbance of temperature developed in the condensation and rarefaction of the wave. The cause and amount of this acceleration was first indicated by La Place; $\frac{1{\cdot}42}{1{\cdot}00}$, the square of the above coefficient being the ratio of the amount of heat expended, including the *external work* done when a gas is heated and allowed to expand under a constant pressure, to the amount expended to produce an equal elevation of temperature, when no external work is performed, the *volume* remaining constant. It is now believed that the same coefficient applies to all gases whose powers of absorption and radiation are inconsiderable.

‡ Nichols's Cyc. of Physical Science. Art. Temperature.

ON THE PRESENCE OF DIDYMIUM IN CERTAIN SPECIMENS OF PYROMORPHITE.

By CHARLES HORNER.

It will be remembered that I drew attention to the fact of the presence of didymium in a specimen of pyromorphite from Cumberland (see Chemical News, vol. xxvi., p. 109, and Professor Church's note thereon, p. 130). Lately, through the courtesy of Professor Maskelyne, I have been enabled to examine other specimens of the above mineral in case 60 at the British Museum, and found that most of the specimens from Loughton Gill, Cumberland, contained this rare element. I likewise detected the absorption lines of didymium in some very elegant specimens of pyromorphite from Wheal Alfred, Cambourne, Cornwall, and in others from the Vale of Towy, Caermarthenshire.

Mortlake, December, 6, 1872.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 5th, 1872.

Dr. Frankland, F.R.S., &c., President, in the Chair.

When the minutes of the previous meeting had been read and confirmed, Messrs. F. W. Fison and T. A. Ormerod were formally admitted Fellows of the Society.

The donations were then announced, and the names of Messrs. George Washington Arnott, James Scott McGregor, and Cornelius A. Mahony read for the first time; for the third time, Messrs. Kigonari H. Yoshida, Francis H. Hobler, Sydney Lupton, E. W. Prevost, Ph.D., Thomas Williams, T. D. Titmal, Joseph Lainson Wills, A. Percy Smith, Philip Braham, John Hollings Mitchell, M.A., Robert William Jones, and A. Cameron Bruce, M.A. who were balloted for and duly elected.

The first two papers "*On Hypophosphites*," and "*On the Reducing Power of Phosphorus and Hypophosphorous Acid and their Salts*," by C. Rammelsberg, were read by the Secretary. In the first paper the author, after mentioning the labours of Rose and Wurtz on this subject, gives a detailed account of the crystalline form, amount of water of crystallisation, and mode of decomposition by heat of the numerous hypophosphites which he had examined, five of which, namely those of sodium, lithium, thallium, cerium, and uranium, had never before been noticed. The results of his experiments show that the hypophosphites of thallium, calcium, cadmium, and lead have no water of crystallisation; those of sodium, lithium, barium, strontium, manganese, and uranium one molecule; whilst those of magnesium, zinc, nickel, and cobalt have six. They are all decomposed by heat, evolving a mixture of hydrogen and phosphoretted hydrogen, which is sometimes spontaneously inflammable and sometimes not, leaving a residue which in most cases consists of a mixture of pyrophosphate and metaphosphate of the metal; but the

residue of the uranyl salt contains phosphide in addition, whilst the nickel and cobalt salts leave a mixture of metaphosphate and phosphide.

In the second paper, mentioned above, the author finds that the ultimate action of phosphorous acid on silver and copper salts is to precipitate the metal whilst hydrogen is simultaneously evolved. Barium hypophosphite with silver salts, and hypophosphorous acid with copper salts, likewise reduce the metal and evolve hydrogen, the acids in both cases being oxidised to phosphoric acid.

Dr. Frankland in asking the members to return their thanks to Professor Rammelsberg for his interesting communication, said that the investigation of these compounds of phosphorus must be welcomed by all chemists. Some important theoretical points presented themselves for discussion, as to the way in which the hydrogen was placed, and the cause of the phosphoretted hydrogen evolved being in some instances non-spontaneously inflammable, and in others spontaneously inflammable, the latter being probably occasioned by the presence of traces of the liquid phosphoretted hydrogen, P_2H_4.

Mr. Vernon Harcourt said that in studying the action of heat on such substances, although they were pure, well crystallised, and homogeneous, we were experimenting under circumstances of a very varying nature. If it were possible to heat the whole of a substance simultaneously to the same temperature, we should probably obtain only one result, but as it was most likely that the substance had been rapidly heated, every part had not been exposed to the same temperature, so that sometimes spontaneously inflammable phosphoretted hydrogen was obtained and sometimes not. In order to study the circumstances under which these different phenomena occurred the subject would need to be very carefully examined.

Professor Williamson remarked that one of the great difficulties in the experiments on the action of heat on the substances described by Professor Rammelsberg, was that one portion of the substance would necessarily be heated in the products of decomposition of another, that is some of the molecules would be decomposed whilst others were heated in a current of the products of decomposition. This, however, was not the only difficulty, for, to take a common case, viz., the action of heat on chlorates, here we have most of the molecules giving off oxygen, but others are simultaneously taking up oxygen to form perchlorates. From a dynamical point of view, we should not expect that individual molecules would have different rates of vibration and therefore behave differently, but the fact remained that some molecules did behave differently from the others.

The President said that he inclined to the opinion that there were very few cases of chemical action where but one product was produced, even under the most favourable and uniform circumstances—that of two gases mixed by diffusion and then exposed to the action of light; there was always some variety of action.

The next paper on "*New Analyses of Certain Mineral Arseniates and Phosphates*," by A. H. Church, was then read by the author. It contained numerous and carefully made determinations of the composition of six minerals.

Apatite.—In the pure crystals of apatite, from Murcia in Spain, the author finds nearly 1 per cent more tricalcic phosphate than corresponds to the formula Ca_53PO_4F, while there is a deficiency of nearly 2 per cent in the calcium fluoride.

Arseniosiderite.—By a series of analyses of a singularly pure specimen of this mineral, the author establishes the formula $5CaO,H_2O,Fe_2O_3,3As_2O_5,+3Fe_2O_3,2H_2O$. It is remarkable that the ferric hydrate, $3Fe_2O_3,2H_2O$, resembles arseniosiderite very closely, it is known as xanthosiderite.

Childrenite.—Numerous analyses have been made of this mineral, the formula—

$$5FeO,2MnO,2H_2O,3P_2O_5+2Al_2H_6O_6+4aq.$$

corresponding well with the analytical results.

Ehlite.—The author gives the analyses of three specimens of this mineral from Cornwall, deducing from them the formula $3CuO,P_2O_5+2CuH_2O_2+aq$. This expression exactly corresponds among the phosphates to that for Cornwallite among the arseniates, the latter mineral having been previously shown by the author to have the formula $3CuO,As_2O_5+2CuH_2O_2+aq$. Professor's Church's conclusions as to this Cornish phosphate of copper were published in abstract in the Chemical News.

Tyrolite.—The author finds this species, like chalchophyllite, which it much resembles, to be strongly hygroscopic. The calcium carbon which it contains is proved to be integral and essential part of the mineral, the formula becoming—

$$\left.\begin{matrix}3CuO\\CaO\end{matrix}\right\}P_2O_5+2CuH_2O_2+2aq.$$

Wavellite.—Some pure samples of this mineral from one of the localities near Cork were examined. It would appear that there are only $11H_2O$ and not $12H_2O$ in this mineral. When dried *in vacuo*, or at 100° C., its formula thus becomes, if we reject the fluorine,—

$$2(Al_2O_3,P_2O_5)+Al_2H_6O_6+8aq.$$

The President thanked Professor Church in the name of the members of the Society for his contributions to our knowledge of these well-known minerals, and also for having supplied constitutional formulæ for some that had hitherto been destitute of them.

The last paper read was "*On the Condition of the Hydrogen Occluded by Palladium as Indicated by the Specific Heat of the Charged Metal*," by W. Chandler Roberts and C. R. A. Wright, D.Sc. In this paper, which is a continuation of the one read before the Chemical Society on the 7th November, the authors give a detailed account of their experiments, and the methods employed in determining the specific heat of palladium, or of an alloy of palladium and gold, when charged with hydrogen by making it the negative pole in the electrolysis of acidulated water, and also of the uncharged metals. Assuming that a true alloy of the metal and hydrogen is formed, it would be easy, in accordance with Kopp's law, to calculate the specific heat of the occluded hydrogen. Since, however, the authors find that the specific heat of the occluded hydrogen calculated in this manner varies according to the amount of hydrogen present in the charged palladium —being as low as 0·4 when the palladium is fully charged, and as high as 0·9 when it is charged with a small volume of hydrogen—they infer that the palladium does not form an alloy with the occluded hydrogen, neither can it be regarded as a mixtnre of a definite palladium hydride with excess of palladium, as in that case either a constant value would be found, or the variation in the specific heat would be represented by a straight line and not by a curved one. The authors are therefore inclined to believe that in palladium charged with hydrogen each several charge must be regarded as giving rise to a distinct compound, and that palladium and hydrogen are capable of entering into combination in proportions which cannot be expressed by comparing simple multiples of the combining numbers of these elements respectively, that is, by simple formulæ.

The results of the experiments were illustrated by a carefully constructed curve.

The President said that the members would, doubtless, have great pleasure in according their thanks to the authors for their important communication on occluded hydrogen, and hoped that it would lead to an examination of the state in which the hydrogen was in this alloy or mixture. It would seem that it was not a definite compound of hydrogen and palladium, and therefore not in the state which the researches of Professor Graham had led us to suppose, and which had excited so much interest.

Mr. Roberts said they were somewhat disappointed that the results of their experiments did not favour the view that it was an alloy of hydrogen and palladium. He might state that the chief reasons why Professor Graham considered the hydrogen to be alloyed with the palladium were the calculated density of the hydrogen in the charged palladium, 0·733, taken in conjunction with its unimpaired

tensile strength, and its high electric conductivity. At the present time the relation between the hydrogen and palladium was very obscure, and could only be elucidated by a long series of carefully conducted experiments.

The meeting was then adjourned until Thursday, December 19, when papers will be read on the "*Analysis of Water of the River Mahanuddy*" by E. Nicholson, and "*On the Polymerides of Morphine and their Derivatives*," by E. Ludwig Mayor and C. R. A. Wright.

CORRESPONDENCE.

THE SALT THAT LOST ITS SAVOUR.

To the Editor of the Chemical News.

Sir,—In your "Notes and Queries" S. T. S. asks if the salt spoken of by Our Saviour was the chloride of sodium. The following personal experience may be interesting.

Some years ago I used salt as a manure on some land, a stiff clay, but interspersed with granules of carbonate of lime. Some of the salt was in hardish lumps, into which the small crystals had become concreted, something like a frozen mixture of ice and snow. These lumps were several weeks before they melted; and before they did so, as they lay on the soil, they lost the taste of salt and acquired that of carbonate of soda. I supposed this to be due to the joint action of the soil and atmosphere. I may add that the salt injured rather than benefited the soil, making it stiffer and wetter than it was naturally for several years.

Many years ago I read in the *Journal of the Royal Agricultural Society* an account of the beds of nitrate of soda in Chili. It was stated there that below the nitrate of soda was carbonate of soda, and below that, common salt. The writer supposed that these beds occupied the bottom of a dried-up salt lake, and that, by the action of the soil and air, the salt had been changed first into carbonate and then into nitrate of soda,—I am, &c.,

H. Highton.

Putney, December 2, 1872.

MISCELLANEOUS.

London Drinking Water.—The following is the second of a series of monthly reports intended as a substitute for the return published by the Registrar General. It is interesting as exhibiting the London water supply at flood-time.

	Parts in a Million. (Milligrms. per Litre.) Free Ammonia.	Albumenoid Ammonia.
Kent Water Co. (Deptford Railway Station, 20th Nov.)	0·01	0·02
New River Co. (Cab Rank, Tottenham Court Road, 21st Nov.)	0·01	0·06
East London Co. (Cambridge Heath Gate, 3rd Dec.)	0·01	0·18
Thames Companies :—		
Chelsea Co. (Cab Rank, Horse Guards, 2nd Dec.)	0·02	0·13
West Middlesex Co. (Cab Rank, Portland Road, 3rd Dec.)	0·00	0·10
Southwark and Vauxhall Co. (Cab Rank, St. George's Road, 4th Dec.)	0·00	0·18
Grand Junction Co. (Cab Rank, Woodstock Street, 4th Dec.)	0·00	0·17
Lambeth Co. (Cab Rank, Palace Road, 2nd Dec.)	0·01	0·16

J. Alfred Wanklyn.

Food Analyst for Islington.—Dr. C. Meymott Tidy, Joint Lecturer on Chemistry, and Professor of Medical Jurisprudence at the London Hospital, has been elected Medical Officer of Health and Food Analyst for Islington.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, December 2, 1872.

In addition to a large number of original papers and memoirs relating to mathematics, hydraulics, mechanics, astronomy, physical philosophy, meteorology, physiology, and natural history, this number contains the following original papers and essays relating to chemistry:—

Practical Observations Relating to the Laws Deduced from the Boiling-Point Temperatures of Homologous Organic Compounds.—I. Pierre and E. Puchot.—This memoir, elucidated by a large number of tables, refers to the correctness of the view held by scientific chemists as to the existence of a constant difference of the boiling-point of the homologous organic compounds, the formula of composition of which differs C_2H_2. By carefully-conducted experiments, the authors prove that there does not exist a constant variation, and they find that two homologous substances, one of which contains more or less C_2H_2, may exhibit, in the temperature of their boiling-point, differences varying from 10° to 35°5°, that is to say, a digression of 25°5 per cent.

New Combination of Bromine and Ether, Bromurated Ether.—P. Schützenberger.—This compound is formed directly by addition (not substitution, for no bromhydric acid is given off) of bromine to ether, but the preparation, described at length, requires dexterous manipulation and pure materials. The bromurated ether, below 0°, is a solid crystalline compound, $(C_4H_{10}O.Br_8)_2$, it is very deliquescent, although it remains solid even at 22°, its fusion-point. The combination is very unstable, being decomposed by the action of potassa, of zinc, and by a temperature of 100°, whereby bromhydric acid, water, bromide of ethyl, bromal, and a new substance, $C_4H_8Br_2O_2$, are formed, according to the following formulæ :—

(1). $2(C_4H_{10}O.Br_8) = BrH + H_2O + \underbrace{3(C_2H_5Br)}_{\text{Bromide of ethyl.}} + \underbrace{C_2H_2Br_2O}_{\text{Bibromated aldehyde.}}$

(2). $\underbrace{3(C_2H_2Br_2O)}_{\text{Bibromated aldehyde.}} = \underbrace{C_2HBr_3O}_{\text{Bromal.}} + \underbrace{C_4H_8Br_2O_2}_{\text{Tribromated di-aldehyde.}}$

Neutral Soap Free from Caustic Alkali.—M. Mialhe.—After first referring to some well-known technical details of soap-boiling, the author describes the process of treating soap-shavings with carbonic acid, whereby the caustic alkali present in soap is neutralised by being converted into a bicarbonate.

Anti-Fermentation Action of Silicate of Soda.—M. Picot.—This essay contains the detailed account of the results of a series of experiments, from which the conclusion is drawn that silicate of soda has the effect of arresting putrid fermentation, even when applied in small quantity. The author also states that the silicate of soda exerts marked physiological and therapeutical action.

Substance Extracted from the Fouh-ling, Pachyma pinctorum.—P. Champion.—The cryptogamic plant just named is found in China, and is used by the natives for the cure of certain forms of syphylitic disease. From this drug, the author, who has travelled through China, has obtained a substance, which he terms pachymose, insoluble in water and in ammoniacal copper solution, soluble in potassa, and then forming, with lime and lead salts, insoluble compounds. When treated with boiling dilute hydrochloric acid, the substance reduces the cupro-potassic liquor, while, with nitro-sulphuric acid, pachymose forms a gun-cotton-like substance. The formula of pachymose is $C_{20}H_{21}O_{29}$.

New Vanadiferous Silico-Aluminate of Manganese found at Salm-Chateau, Belgium.—F. Pisani.—The mineralogical description of this mineral is given at length. The sp. gr. of the substance is 3·577; it fuses readily in the blowpipe-flame, forming a black-coloured enamel. Its percentical composition is—Silica, 28·7; alumina, 28·36; peroxide of iron, 2·94; protoxide of manganese, 26·40; lime, 4·30; magnesia, 4·32; oxide of copper, 1·30; vanadic acid, 1·80; loss by ignition, 0·98; total, 99·10. The composition of this mineral, which is to be named Dewalquite, in honour of the eminent Belgian

mineralogist, Dr. Dewalque, resembles that of masonite, by supposing the iron therein contained to be replaced by manganese.

Le Moniteur Scientifique Quesneville, No. 372, December, 1872.

This number contains the following original memoirs relating to chemistry and collateral subjects:—

Platinum Coinage.—A. Jouglet.—In the introduction to this paper, the author discusses the question whether aluminium might be used as a substitute for bronze or copper coinage. His opinion is that the metal is not a suitable material for this purpose; but if there are invented cheaper methods for the production of aluminium, some of its alloys might be suitably used for coinage. Next, we have the enumeration of the properties of metals in general, so as to render them suitable for coinage. These properties, partly inherent to the metal itself, partly due to its intrinsic value (comparative scarcity), are all possessed in a high degree by platinum, which has been in use as a coin in Russia, but was demonetised by the imperial ukase of June 22, 1845, the reason being that at and before that period the proper methods of working and refining platinum were not well understood. In this respect, however, the researches of Drs. H. Sainte-Claire Deville and Debray, and Messrs. Johnson and Matthey, have made such changes, that there would now be no difficulty in the working of platinum into coins, and, unlike gold and silver, it would be proof against forgery, on account of its high specific gravity. So far back as 1799, experiments were made at the French Mint, at Paris, for the purpose of converting platinum into coins, and Duvivier produced at that period some beautiful specimens of platinum medals. This metal is still largely used for the same purpose in France. The author enters into exhaustive details on the alloys of platinum which might be used as material for coinage, and also gives some statistics on the annual production of platinum in different countries, observing that Dr. Pettenkofer's researches prove that platinum is more generally dispersed than is commonly believed.

Estimation of the Total Quantity of Phosphoric Acid present in a Soil.—E. Grandeau.—The author first thoroughly dries a fair average sample of the soil, and next passes it through a fine sieve, thus eliminating pebbles. 100 grms. of the powder are then taken, and acted upon by pure nitric acid, aided by heat kept up for several hours. The acid solution is decanted, or, if necessary, filtered, and the insoluble residue well washed with distilled water, and the filtrate made up to 500 c.c. Into 100 c.c. thereof an excess of a solution of molybdate of ammonia is poured, and the precipitate of phospho-molybdate collected on a filter, well washed, and next dissolved in strong ammonia. The solution thus obtained, which should be clear and colourless, is used for estimating the phosphoric acid in ammonio-magnesian phosphate. Generally, the author makes a second estimation with another 100 c.c. of the original fluid, and finds that the difference in the two assays does not exceed 0·0005 grm. of phosphoric acid.

Although not belonging to chemistry, we call attention to the following essay:—

Transmission of Cholera by Ships, and on the Organisation of Quarantine.—Dr. M. Pettenkofer.

Bibliography.—Under this heading, we quote the title of the following work:—"Traité des Dérivés de la Houille Applicables à la Production des Matières Colourantes," par MM. Girard et G. de Laire; 1 vol., grand 8vo., de 650 pp., avec 12 planches. G. Masson, Paris; price 16 francs. This important work is divided into the following chapters:—Formation of tar; chlorated derivatives of the hydrocarbons; sulpho-derivatives of the aromatic carburets (*carbures aromatiques*); nitrated derivatives of the aromatic carburets; the coal-tar alkaloids; secondary and tertiary monamines; aromatic diamines; phenolen-diamine and isomers thereof; triamines; industrial applications; industrial manufacture of the coal-tar colours. The plates of this work, exhibiting apparatus and machinery, are drawn and engraved to scale.

Les Mondes, December 5, 1872.

Reorganisation of the Observatories in France.—By a decree of the President of the Republic, a committee of astronomers, mathematicians, and other *savants* has been appointed for the purpose of preparing a Bill to be presented to the Legislative Assembly, with the view of re-organising the existing observatories.

Oxyhydric Illumination.—Rev. Abbé Moigno.—The author reviews, in this paper, the official Report of F. Le Blanc, already briefly referred to in our columns (see Chemical News, vol. xxvi., p. 625), and points out that many of the conclusions arrived at by that gentleman are contradicted by the practical experience obtained at Brussels, Vienna, New York, and other large cities, and that the researches of Dr. Schilling, one of the most eminent scientific managers of gas-works, are also completely at variance with the views of Le Blanc.

November Meteors.—M. André and the Rev. Father Dutirou, S.J.—The authors communicate, from different localities of France (viz., the former from Crépol, the latter from Montauban), that during the night of November 27th last there was witnessed what might almost be termed complete showers of meteors. The weather was calm, sky clear, and the temperature moderately high for the season.

White Gunpowder.—L'Abbé Fortin.—It appears that, some three years back, the author invented a compound (the constituents are not mentioned) which, according to experiments made by competent artillerists and scientific men, possesses advantages over ordinary gunpowder, gun-cotton, prussiate powder, picrate of potassa powder, &c., in its mode of preparation, its freedom from danger by storage, as well as its not exploding by concussion, and the cheapness of its constituent materials, while its balistic force is five times greater than that of the best ordinary gunpowder. The author also states that he can alter the mixture to any desired degree of strength and inflammability.

Thermoscopic Barometer.—A. Guiot.—The exhaustive description, elucidated by algebraical formulæ, of an ingeniously-contrived instrument, invented by the author, who received for it the silver medal of the Société d'Encouragement pour l'Industrie Nationale, and also a sum of money. It appears that the instrument has been found to give really correct indications, but hitherto it has not been sufficiently noticed out of Paris, where it is sold for 12 francs. The excellent editor of *Les Mondes* mentions incidentally that it has been tried with success in coal-pits as an indicator of the approach of fire-damp explosions, due to decrease of atmospheric pressure.

Journal für Praktische Chemie, Nos. 14 and 15 (double number), 1872.

Some Derivatives of Mucic Acid.—M. Kœttnitz.—The end of this essay; this portion contains the following sections:—Behaviour of mucate of aniline when submitted to dry distillation; phenyl-pyrrol—

$$\left.\begin{matrix}C_4H_4\\C_6H_5\end{matrix}\right\}N;$$

phenyl-pyrrol-mercuro-chloride—

$$2\left(\left.\begin{matrix}C_4H_4\\C_6H_5\end{matrix}\right\}N\right)HgCl_2;$$

mucate of toluidine, $C_6H_{10}O_8(C_7H_9N)_2$; mucate of toluidine—

$$\left.\begin{matrix}C_7H_7H\\C_6H_8O_6\\C_7H_7H\end{matrix}\right\}N_2;$$

behaviour of mucate of toluidine when submitted to dry distillation.

Preparation and Properties of Protochloride of Gold (Gold-chlorür).—G. Leuchs.—After briefly referring to the modes of preparation and description of properties of this compound, as quoted in various works treating on chemistry, the author records at length the results of his experience in its preparation. It is best obtained by gently heating the perchloride of gold to from 180° to 200°, care being taken to stir the saline mass, which constantly evolves chlorine. The pure protochloride exhibits a yellow colour; this compound is decomposed by water and moist air, the result being the formation of metallic gold and perchloride of gold.

Detection of Water in Essential Oils.—G. Leuchs.—When, to the oils mentioned, a large quantity of petroleum ether (benzoline) is added, the water, if any is present, becomes apparent in the shape of drops.

Fortuitous Formation of Rosolate of Lime.—G. Leuchs.—On pulling down a roof covered with tarred felt, it was found that the layer of lime placed below it had in some parts become converted into rosolate of lime.

Products of the Action of Sodium upon a Mixture of Phosgen Ether and Iodide of Ethyl.—A. Geuther.—Notwithstanding the intrinsic value of this essay, its contents are not suited for abstraction, an observation also applying to the following memoir:—

Molecular and Usual Colours of the Metals, more particularly Gold, and on the Blue-Coloured Combination of Sulphur and Sulphuric Acid.—W. Stein.

Immediate Constituents of Bone-Ash.—Dr. C. Aeby.—This paper treats on a peculiar decomposition which the inorganic matter of bones undergo while being converted into bone-ash, and which is due to the loss of water of crystallisation of the phosphate of lime, and the action of the lime rendered caustic (from carbonate) upon the orthophosphate of lime.

Researches on Green Stones.—T. Petersen.—This mineralogico-chemical monograph is divided into the following sections:—Introduction and general review; the felspar theory; oligoclase from the diorite at Hof; oligoclase from the gneiss at Aschaffenburg; oligoclase from diabase; on the main constituents of massive rocks; felspar, augite, and hornblende; chlorite; magnetic and titanic iron; apatite; formation of serpentine; green stones as the matrix of many useful minerals and ores; method of chemical investigation; the diabases; general characteristics; fine-grained diabase from the Oderbach road, near Weilburg (Nassau-Prussia); coarse-grained diabase from the Lahn tunnel, a tunnel constructed for widening and canalising the river Lahn, at Weilburg; porphyroide diabase from Grävenek, near Weilburg; coarse-grained diabase from Tringenstein. This monograph, which is to be continued, is elucidated by a large number of results of analysis and complex formulæ. The rocks here alluded to also occur largely in some parts of Scotland, and are excellent as building-stone. Taymouth Castle is built of green stone, *chlorit-schiefer*.

Gazzetta Chimica Italiana, No. 7, 1872.

New Species of Calculi Urinarii from Cattle—Lithurate of Magnesia.—Dr. G. Roster.—The author relates at length under what conditions these urinary stones were emitted by the cattle, and describes the physical appearance, size, and weight of these stones, which he found to consist of lithurate of magnesia, $C_{30}H_{38}N_2MgO_{17}$. The litburic acid is a snow-white crystalline substance, soluble in water and in alcohol; fusion-point, 204·5°; the small quantity of the acid obtained did not admit of establishing its chemical formula with

certainty, but it would appear that any of the following formulæ apply to this body:—$C_{29}H_{38}N_2O_{17}$; $C_{30}H_{38}N_2O_{18}$; $C_{15}H_{19}NO_9$.

Composition of Two Different Varieties of Sorghum Seeds.—Prof. A. Cossa.—The author has investigated the seeds of the sugar-yielding Sorghum and of the variety which is not sweet; the average weight of the former seed is 0·243 grm., that of the latter 0·284 grm. The composition of the sweet Sorghum seed, in 100 parts, is—Water, 14·19; organic matter, 82·84; ash, 2·97. Nitrogen, in 100 parts, 1·571; fatty matter, 3·32. The seed which is not sweet contains, in 100 parts—Water, 13·21; organic matter, 84·84; ash, 1·95. Nitrogen, 1·484; fatty matter, 3·13. Husks of the sweet Sorghum seed contain, in 100 parts—Water, 12·94; organic matter, 81·87; ash, 5·19, of which 58·9 per cent is silica. The husks of that which is not sweet contain, in 100 parts—Water, 12·08; organic matter, 83·12; ash, 4·80, of which 67·94 per cent is silica.

Preparation of Caustic Potassa and Caustic Soda.—E. Pollacci.—The author discusses Dr. Wöhler's method (the reaction of copper at red heat upon the nitrates of the alkalies), and next a method invented by him of heating an intimate mixture of 2 to 3 parts of iron-filings with 1 part of nitrate of potassa, which mixture is heated to redness in an iron retort or crucible; the reaction which takes place is exhibited by the following formula:—

$$6KNO_3+10Fe=3K_2O+5Fe_2O_3+6N.$$

Means of Ascertaining the Nature of the Dyes Applied to Woven Fabrics.—L. Gabba.—An essay of intrinsic value, but not suited for abstraction.

Chemical Composition of the Ash of the Leaves and of the Fruit of Lemons.—Prof. A. Cossa.—This lengthy essay contains, in the shape of a large number of tables, the results of a series of analyses of the ash of the leaves, fruit, and seeds of various kinds of lemons, and also of the soil on which the trees producing the same are grown; the contents of this essay are, however, mainly of local interest; these observations equally bear upon the following memoir:—

Chemical Researches on the Ripening of Grapes.—Prof. A. Cossa.

Annales de Chimie et de Physique, December, 1872.

This number contains the following original papers and memoirs:—

Researches on Nitro-Toluen.—Dr. Rosensthiel.—This exhaustive monograph is divided into the following sections:—Introduction, containing a review of the labours of several *savants* on this subject; immediate analysis of nitro-toluen; origin of the isomerism of the two nitro-toluens; is toluen a mixture of two isomeric carburets *(carbures)* on the simultaneous formation of the isomeric nitro-toluens in definite proportion? comparative study of the isomeric nitro-toluens; nitro-toluen-α (para-nitro-toluen of Beilstein and Kuhlberg; binitro-toluen-α (meta-para-binitro-toluen of Beilstein and Kuhlberg; nitro-toluen-β (meta-nitro-toluen of Beilstein and Kuhlberg).

Propagation of the Instantaneous Current of the Leyden Jar.—C. M. Guillemin.—Illustrated with woodcuts.

Light Emitted by Phosphorescent Uranium Compounds.—E. Becquerel.—This essay is the enlarged paper read by the author in the Academy of Sciences (see CHEMICAL NEWS, vol. xxvi., p. 82).

La Revue Scientifique de la France et de l'Etranger, November 30, 1872.

This number contains the following original memoir collaterally relating to chemistry:—

Evolution of Organic Matter by the Processes of Living Organisms.—Dr. Wurtz.—The first portion of a series of papers on chemical biology.

December 7, 1872.

This number contains, in addition to a letter from the Minister of Public Instruction concerning the opening of the New Medical Faculty at Nancy, and the *éloge historique* on Isidore Geoffroy Saint-Hilaire, by Dr. J. Dumas, the following original essays relating to chemistry:—

The Hydrates of the Monobasic Fatty Acids.—E. Grimaux.—Not suited for abstraction.

Chemical Studies on Vegetation.—J. Raulin.—The results of the author's researches on the growth and development of the *Aspergillus niger*, and on the various conditions which promote, retard, or entirely prevent the formation of this microscopic cryptogamic plant.

Some curious statistics concerning the average duration of life of the Academicians are recorded in a paper written by M. Potiquet.

Bulletin de la Société Chimique de Paris, November 15, 1872.

This number contains no original papers.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, No. 240, December, 1872.

This number contains the following original paper relating to physical science:—

Report on, and Theory of, Bourbouse Balance Galvanometers.—M. De Lissajous.—This essay is illustrated by engravings, and contains the minute description of an ingeniously-contrived physical instrument of great value.

This number contains the exhaustive programme of the prize essays proposed to be answered by this society for the years 1873 to 1878 inclusive.

PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2672. E. Withy and W. Gibson, West Hartlepool, Durham, "Improvements in puddling furnaces, and in preparing iron for being operated upon therein and charging, such improvements in preparing for and charging being applicable in connection with cupolas, vibratory and refinery furnaces."—Petition recorded September 9, 1872.

3382. E. A. Cowper, Great George Street, Westminster, "Improvements in separating the fibres of materials producing paper pulp, and apparatus therefor."—Petition recorded November 13, 1872.

3412. G. Alsing, Preston, Lancashire, "Certain improvements in the treatment of night-soil and other refuse matter."—Petition recorded November 15, 1872.

3421. T. Bagley, Birmingham, "A new or improved varnish."—Petition recorded November 16, 1872.

3445. R. Hornby, Marchmont Street, Middlesex, "Improvements in treating fatty materials in combination with various kinds of pitch, alkalies, and oil, also in the treatment of animal, vegetable, and mineral oils for lubricating purposes."

3446. C. D. J. Seitz, Edinburgh, N.B., "An improved apparatus for, and method of, treating wood and other similar substances for the manufacture of half-stuff and paper."

3451. C. L. Siecimoski, Balham, Surrey, "Improvements in the preparation of photographic tracing-paper, and in the fluid employed in connection with the same."—Petitions recorded November 19, 1872.

3470. W. G. Brunner, Glasgow, N.B., "An improved process for annealing and cleansing the surfaces of iron or other metals."—A communication from Messrs. Schulz and Heyl, Berlin.—Petition recorded November 20, 1872.

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

3502. T. A. Howland and C. G. McKnight, M.D., Providence, Rhode Island, U.S.A., "Improvements in the manufacture of gas, and in apparatus therefor."—Petition recorded November 22, 1872.

NOTICES TO PROCEED.

2137. J. Dale, Manchester, "Improvements in the manufacture of oxalates of soda and potash."—Petition recorded July 17, 1872.

2262. T. R. Crampton, Great George Street, Westminster, "Improvements in the manufacture of gas and fuel, and in apparatus to be used for this purpose."—Petition recorded July 29, 1872.

2276. W. B. G. Bennett, Nichols Square, Hackney Road, and J. C. Watt, Lancaster Road, Notting Hill, Middlesex, "Improvements in the preparation of asphalte, and in the application thereof to the construction of roads and footpaths and other purposes."

2286. A. Browne, Gracechurch Street, London, "Improvements and modifications in the treatment of phosphate in general, and in the production and purification of phosphoric acid and its combinations."—A communication from H. Storck, E. Hentsch, A. Hentsch, A. Lutscher, and F. Grininger, Paris, France.—Petitions recorded July 30, 1872.

2476. A. Deiss, Plaistow, Essex, "A new or improved process of percolation, for the purpose of extracting fatty, resinous, and similar matters."—Petition recorded August 20, 1872.

3163. A. Alison, Bayswater, Middlesex, "Improved means of preserving and curing raw meat, in packing the same, and in apparatus employed therewith."—Petition recorded October 25, 1872.

3192. E. P. H. Vaughan, F.C.S., Chancery Lane, Middlesex, "Improvements in the mode of, and apparatus for, generating gas for lighting and heating purposes."—A communication from E. A. Dubois, Paris.—Petition recorded October 28, 1872.

3273. J. B. Spence, Manchester, "Improvements in obtaining anthracene, and in apparatus connected therewith."—A communication from J. C. F. Cheever, New York, U.S.A.—Petition recorded November 4, 1872.

3292. E. J. W. Parnacott, Leeds, "Improvements in artificial fuel, part of which improvements having reference to the means or apparatus employed in the manufacture of the same."—Petition recorded November 6, 1872.

3309. H. Deacon, Widnes, Lancashire, "Improvements in the manufacture of bleaching-liquor."—Petition recorded November 7, 1872.

PATENTS SEALED.

1616. J. H. Dennis, Liverpool, "Improvements in the treatment of copper precipitate and in the utilisation of impurities contained therein."—Dated May 28, 1872.

1634. L. G. Lysons, Gloucester, "Improvements in the manufacture or composition of paints or substances for covering or coating various surfaces."—Dated May 30, 1872.

1690. W. Riddell, Bishopsgate Street, London, "Improvements in the manufacture of paper pulp from vegetable fibres and in apparatus therefor, which apparatus is also designed to be employed in making chloride of lime for bleaching pulp, and in other similar processes."—Dated June 4, 1872.

2506. E. A. Cook, Viewville House, Midlothian, N.B., "Improvements in treating animal charcoal."—Dated August 23, 1872.

2845. F. Walton, Staines, Middlesex, "Improvements in oxidising oil, and in machinery to be employed for that purpose."—Dated September 26, 1872

2950. T. Greener, Darlington, and W. Ellis, Gateshead, Durham, "Improvements in the manufacture of iron, and in the production of

'fetling' for improving the quality and yield of iron in the process of reduction."—Dated October 7, 1872.

2964. H. Larkin, Theydon Gernon, Essex, A. Leighton, Liverpool, and W. White, Hampstead, Middlesex, "Improvements in the production of iron and steel."—Dated October 8, 1872.

FOREIGN PATENTS.

BELGIUM.

31372. H. D. Poizot and A. Lagrelle, "Double extraction of beet-juice."

31374. L. and J. Jacobi, "An alloy which is proof against atmospheric action."

31391. J. B. Wattiaux, "New economical fuel."

31393. B. Todd, "Improvements in the treatment of gases and fumes."

31397. E. A. Dubois, "Improvements in the manufacture of lighting-gas, and in apparatus belonging thereto."

31400. F. Ransome, "Obtaining artificial stone."

31403. J. Palliser, V. Grumel, and A. Klopsk, "Decolouring and bleaching textile substances."

31407. C. de Sainte-Marie, "Preparing skins."

31408. D. Urquhart, "Improvements in preserving animal and vegetable substances."

UNITED STATES OF AMERICA.

132154. R. Guenther, "Washing compound."

132204. E. Fabra, "Medical compound for the cure of cholera in hogs, &c."

132233. S. M. Barnes, "Medical compound or anti-dyspeptic bitters."

132242. C. G. Bruce and M. J. Stein, "Process and apparatus for rendering and drying animal matter."

132243. C. G. Bruce and M. J. Stein, "Process and apparatus for treating and drying animal matter."

132264. H. H. Eames and C. J. Eames, "Treating ammoniacal liquor of gas-works, &c."

132265. H. H. Eames and C. J. Eames, "Manufacture of illuminating gas from hydrocarbons."

132266. H. H. Eames and C. J. Eames, "Vaporising hydrocarbons for heating, &c."

132269. W. Farris, "Tanning compound."

132272. F. G. Ford, "Preserving tomatoes."

132275. R. A. Gettins, "Medical compound."

132296. H. Lerner and E. C. Harpold, "Apparatus for the manufacture of bromine."

132324. L. H. Rogers, "Carbonised paper."

132331. L. Stevens, "Furnace for treating ores."

MEETINGS FOR THE WEEK.

MONDAY, Dec. 16th.—Medical, 8.
—— Society of Arts, 8. Dr. C. Meymott Tidy. Cantor Lectures.

TUESDAY, 17th.—London Institution, 4.
—— Civil Engineers, 8. Anniversary.
—— Anthropological, 8.

WEDNESDAY, 18th.—Society of Arts, 8.
—— Geological, 8.

THURSDAY, 19th.—Zoological, 4.
—— Royal, 8·30.
—— Chemical, 8. E. Ludwig Mayor and C. R. A. Wright, "On the Polymerides of Morphine and their Derivatives." E. Nicholson, on "Analysis of Water of River Mahanuddy." Dr. H. E. Armstrong, "Communications from the Laboratory of the London Institution." J. L. Davies, "On the Formation of Crystallised Copper Sulphide, &c."
—— Philosophical Club, 6.

TO CORRESPONDENTS.

*** Vol. XXV. of the CHEMICAL NEWS, containing a copious index, is now ready, price 11s. 4d., by post, 12s., hansomely bound in cloth, gold lettered. The cases for binding may be obtained at our office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our office, or, if accompanied by a cloth case, for 3s. Subscribers wishing to complete their sets of volumes are requested to apply to the publisher, who will give them information respecting scarce numbers and volumes. Vol. xxvi. commenced on July 5th, and will be complete in twenty-six numbers. READING CASES, price 1s. 6d. each, post free, may also be obtained at the Office.

W. Pakeman.—(1) Gentele's "Lehrbuch der Farbenfabrikation.' (2) For practical purposes it is insoluble.

A Reader.—You will find the information in Brande's "Dictionary of Science, Literature, and Art," vol. iii. p. 313. Rottenstone is a peculiar kind of tripoli; you will find further information in Dana's "Mineralogy," p. 199. Both works may be consulted at the Library of the Commissioners of Patents.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated with numerous Wood Engravings.

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The CLASSES will meet as usual.

The CHEMICAL and TOXICOLOGICAL CLASS on Monday and Thursday evenings at 8 p.m., commencing October 1st.

The LATIN CLASS on Tuesdays and Fridays at 8 p.m., commencing October 2nd.

The MATERIA MEDICA and BOTANICAL CLASS, every Wednesday and Saturday at 8 p.m., commencing October 3rd.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 682.

ON

SUPERPHOSPHATES—THEIR ADULTERATIONS AND VALUATION.

By J. EMERSON REYNOLDS, M.R.C.P.,
Professor of Analytical Chemistry to the Royal Dublin Society,
Keeper of the Minerals, &c.,

However much we may lament the existence of fraudulent dealing on moral grounds, it appears to me a study of high interest to follow this "trail of the serpent" amongst the things around us, to measure its effect upon the general welfare, and to devise means for its detection and suppression. In order to pursue such an inquiry with advantage, we must select a particular class of fraud; and the class to which I invite your attention this evening is that so frequently the subject of investigation by the analytical chemist—viz., the adulteration of articles of commerce. But I may further restrict the few remarks I have to make to a special order of adulteration which materially affects the agricultural community. The frauds to which I refer are those connected with artificial manures; but more particularly with the very important group of fertilisers included under the term "superphosphates."

We have had the opportunity of watching, for many years past, the steady development of a great trade in artificial manures, and the corresponding outcrop of devices by which dishonest traders have imposed on the farmer—with the result of diminishing his produce, and thus indirectly affecting the community at large.

To the agriculturist as to the manufacturer, the value of a superphosphate is directly proportional to the amount of soluble phosphate, insoluble phosphate, alkaline salt, and ammonia, either ready-formed or latent, that it contains. A very few seasons since, it was by no means uncommon to meet with superphosphate sold at a good price, and containing *no* soluble phosphate, and but a small proportion of other valuable substances—clay, road-stuff, gypsum, or waste products of various kinds from chemical works being used up in preparing the very feeble fertiliser. The same materials, of little value, were still more frequently used for diluting the genuine manure, and this practice is far from being uncommon at present.

I need not stop to consider in any detail the effect of this dishonest dealing on the farmer—his wasted means, unrequited labour, and consequent disappointment. To do more than refer to these misfortunes, and to the consequent national loss, would be to repeat an oft told tale.

The adulterators of superphosphate, bold though they were at first, soon received a check, for agricultural societies employed chemists in the detection of the frauds, with the result of obliging the greater cheats either to rest satisfied with the profits derivable from small adulterations, or to transfer their attentions to guanos or other substances that could be rather more safely tampered with.

Speaking now from my experience as chemist to this Society, I am justified in stating that gross adulterations of superphosphate are now rarely practised—probably not because the dishonest dealer has lost the desire for large profits, but for the sufficient reason that the risk of detection is now too great. He has, therefore, fallen back upon the more subtle plan of mixing with a manure a quantity of some nearly worthless substance that it already contains as a natural constituent. The addition of gypsum to a superphosphate is an adulteration of this kind, for all these manures contain gypsum as a necessary product of the action of oil of vitriol on phosphate of lime, whether the latter is derived from bones, coprolites, or other similar mineral phosphates. When this addition of extraneous gypsum falls within certain limits, it is difficult to prove the adulteration, as manures of the same kind, and honestly prepared, are known to vary somewhat in composition. Now, under these circumstances it will be asked, What control have we over this more refined kind of adulteration? The answer to this ought to be, that a complete system of chemical valuation is employed by means of which any sensible reduction from a common standard is at once detected. But such an answer cannot as yet be truly given. Manures of the class referred to certainly have money values attached to them after analysis made on behalf of the purchaser or the vendor; but a very few examples will suffice to show how little importance is to be attached to such estimates. Thus, we find a manure selling at £6 per ton valued at £8 15s.; another, whose selling price is £6 5s., valued at £9 8s.; others, sold at £6 10s., £6 6s., and £7, appraised by one chemist at £7, £8, and £8 10s., respectively, and by another at £6 18s., £7, and £7 2s., though the two sets of analyses fairly agreed and were made about the same time. These discrepancies are accounted for to a considerable extent by supposing that one chemist attaches much more importance to certain constituents than another does; one values in the interest of the vendor, the other in that of the purchaser, and all the estimates are wide of the truth. Valuation of this kind, however, is probably useful for purposes of comparison when a particular set of samples are under examination; but, for general use, the system is simply misleading, and unable, in its present guise, to afford the information we require in dealing with doubtful cases. Hence, about three years ago, I ceased to assign money values to manures, unless where specially requested to do so on receiving a sample for analysis. I understand that Dr. Vöelcker, the distinguished chemist to the Royal Agricultural Society of England, now declines to attach a money value to a sample of manure under any circumstances.

Nevertheless, a satisfactory system of valuation ought to be constructed, as it is capable of rendering great service. I venture to think that no insuperable difficulties lie in the way, and my chief object is to lay before you the details of a plan for estimating relative values of superphosphates which appears to be fair alike to vendor and purchaser. If I succeed in proving to you, in the first place, that we may precisely fix the relative commercial values of the constituents of a superphosphate, and secondly, that we can take a standard to which reference can be made, it will be easy to complete the work and to show how the data may be utilised.

In dealing with the first branch of this question, it is well to explain at the outset the method of valuation at present employed. A certain money value per ton is assigned to each important constituent of a manure, thus: Ammonia, at £95 per ton; soluble phosphate, £30; insoluble phosphate, £11; alkaline salts, £3; organic matter, £1; gypsum, £1. A sample is analysed, and the percentage statement is held to indicate the composition of 100 tons. The number of tons of each body present is then multiplied by its price per ton, the various amounts then added together, and the estimated value of 100 tons obtained.

Having indicated the system at present in use, we now have to fix the relative values of the important constituents, by consulting dealers in the several raw materials as to their cost, and manufacturers of manure as to the expense attending the necessary treatment, excluding charges which do not affect the *relative* values. I have to acknowledge here the promptitude and courtesy with which my inquiries have almost invariably been met by many merchants, agents, and manufacturers. With-

out giving details of outlay, with which I have been kindly furnished in confidence from several quarters, I may now state the table of equivalent numbers that I have been thus enabled to construct, and these represent the mean of the several values at the present time. We may eliminate the organic matter that appears in an analysis from our list, since I give the equivalent of its latent ammonia, and gypsum, also because the equivalent of biphosphate includes that of the corresponding sulphuric acid of the gypsum. The table is therefore limited to the following six bodies, and these are referred to ammonia as unity :—

Ammonia, ready formed	1·0
Ammonia, latent	2·2
Biphosphate	4·0
Bone phosphate	8·0
Mineral phosphate	13·0
*Alkaline salts	22·5

This table somewhat resembles that of equivalents of the elements used in chemistry ; that is to say, the numbers are strictly proportional to one another, and indicate the replacing values of the different bodies to the manufacturer.

The table also fairly represents the average relative values of the several substances to the farmer. Now, though the *average* agricultural values are not subject to fluctuation, the numbers in the above table require slight corrections to be applied to them from time to time, owing to variations in the *relative* cost of materials. Where any change of the kind is necessary, the correction should be applied prior to the commencement of each season, in order that all manures sold during a particular period should be fairly judged in the same way.

We have therefore substituted for money values a series of proportional numbers that can be used with great advantage, and have thus made the first step toward the solution of the proposed problem. As an example of the mode of using the figures, I may give the following analysis of a fair mineral superphosphate offered for sale at £6 per ton :—

100 parts contained—

Water	12·85		
*Organic and volatile matter	22·65		
Biphosphate	16·99	÷ 4·0 =	424·2
Neutral phosphate (mineral)	12·25	÷ 13·0 =	94·2
Alkaline salts	1·50	÷ 22·5 =	6·6
Sulphate of lime	29·06		
Sand, &c.	4·70		
	100·00		
*Ammonia	0·40	÷ 1·0 =	40·0
			565·0

In the above analysis, not made by me, the ammonia is not stated to be ready formed, nor is it shown to be latent. Under these circumstances, I consider it fair to the manufacturers to assume that it is immediately available, though it is highly improbable that all the nitrogen exists in the manure as ammonia. The percentages of the four valuable constituents have been divided by the corresponding equivalent numbers, and in the products the decimal points shifted two places to the right, in order to get convenient terms. The numbers have then been added together, and the product I call 565° on the R. D. S. scale of relative value. Instead of shifting the decimal points in the products, we may obviously do away with the decimal points in the analytical statement, and take the numbers given to represent parts in 10,000.

I now give a number of analyses of mineral and bone superphosphate made by different chemists. The samples are numbered, and the manufacturers' names suppressed, for obvious reasons. The *agents'* price to the farmer is given in each case, and the degree of the manure marked on the plan just described.

SUPERPHOSPHATES.

	MINERAL.					BONE.					
	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Selling price per ton	£6	£6 10s.	£6 10s.	£6 10s.	£6 10s.	£8	£8	£8	£6 15s.	£8	£8
Degrees on Royal Dublin Society's scale	595°	630°	615°	520°	509°	883°	537°	600°	573°	655°	811°
Water	16·10	15·97	17·50	23·30	19·75	—	18·70	14·40	16·60	14·37	8·20
Organic matter, &c.	17·52	14·53	12·25	15·70	16·95	37·39	16·59	25·25	28·25	23·98	21·53
Biphosphate	15·92	20·55	19·52	14·36	16·15	11·30	14·30	11·05	12·72	17·40	19·28
Neutral phosphate	10·00	13·10	14·90	14·33	6·80	18·00	2·60	4·55	8·55	8·40	16·25
Alkaline salts	4·55	0·80	0·46	2·45	0·52	3·00	trace	3·44	1·95	1·05	1·45
Sulphate of lime	32·89	30·80	29·42	26·11	35·31	27·71	41·41	36·16	27·75	31·10	27·47
Insoluble matter	3·02	4·25	5·95	3·75	4·52	2·60	6·40	5·15	4·18	3·70	5·82
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ammonia	1·00	0·13	0·12	0·12	0·30	3·62	1·49	2·53	1·40	1·10	1·20

Having pointed out the manner in which the table of equivalents can be used for the purpose of obtaining an accurate expression for the relative total values, we may discuss the data, and endeavour to deduce standards for the two classes of superphosphates.

Mineral Superphosphates.—With the exception of Nos. 1 and 2, all those manures whose analyses are given were sold at £6 10s. per ton to the farmer. By adding in each case one-thirteenth to the number found for Nos. 1 and 2 on the Royal Dublin Society's scale, we can consider them as if sold for £6 10s. per ton each —and therefore compare their number with those given for the remaining samples.

* The value of alkaline salts varies chiefly according to the proportion of potash salts present. In my opinion, it would be unfair to the manufacturer to assign to them a lower relative value than that given in the table.

In the following table these corrections have been made :—

Number.	Sold to Farmer at—	Degree on R.D.S. Scale.
1.	£6 10s.	612°.
2.	6 10s.	644°.
3.	6 10s.	630°.
4.	6 10s.	615°.
5.	6 10s.	520°.
6.	6 10s.	509°.

Dismissing Nos. 5 and 6 as being of inferior quality, we have four of these superphosphates, made by different manufacturers, sold at the same price, and approaching closely to each other in the number of degrees reached on the Royal Dublin Society scale. They are undoubtedly

useful fertilisers, and their mean number agrees with the mean afforded by my own analyses of corresponding samples. We are therefore in a position to fix our standard of value for a mineral superphosphate as follows:—*Samples marking 620° on the Royal Dublin Society scale above described, should not cost the farmer more than £6 10s. per ton.*

From the foregoing we at once deduce the simple and convenient statement, that a manure marking 600° R.D.S. degrees is worth just *six guineas* per ton.

A single example of the use that I make of this "Royal Dublin Society Standard Mineral Superphosphate" will suffice. Let us suppose that a farmer purchases a sample of mineral superphosphate at £6 10s. per ton, and that on the discussion of its analysis it affords the same number as No. 6, namely, 509° on the R. D. S. scale; we at once report the manure to be value for only £5 6s. 8d.

The money value obtained on the old plan and actually attached to No. 6 by the analyst was £6 7s. per ton. The latter estimation would, therefore, indicate to the purchaser at £6 10s. that he obtained fair value for his money, though really paying about £1 per ton too much. My system at once detects and measures this serious reduction in value.

Bone Superphosphates.—In these cases the equivalent number "8" of a bone phosphate (see table) has been used for dividing the insoluble phosphate; the number 13 being used for the same purpose in discussing the analyses of the mineral superphosphates. The superiority of undissolved bone phosphate over the mineral phosphate in the same condition being thus fully and fairly recognised, the degrees on the R. D. S. scale afforded by the bone manure of course have the same meaning as when deduced from the analysis of a mineral superphosphate. Our standard mineral superphosphate, therefore, measures the value of a bone manure. If, then, the former is only value for £6 10s. per ton, when it marks 620° on the R. D. S. scale, the bone manure is only value for £8 per ton when it reaches 763° on the same scale.

Having deduced our standard from the previous inquiry, we may now ascertain how far the result is confirmed on the discussion of the above given analyses of bone superphosphates.

We first have to raise the equivalent of No. 10 from 573° to 679°, being in the ratio of £6 15s. to £8, and then tabulate the numbers as before, thus:—

Number.	Sold to Farmer.	Degree on R.D.S. Scale.
7.	£8 0 0	883°.
8.	do.	537°.
9.	do.	600°.
10.	do.	679°.
11.	do.	655°.
12.	do.	811°.

Nos. 7 and 12 are derived from vendor's analyses, the rest from those of purchasers. No. 8 is so obviously a very inferior manure that we may dismiss it from consideration. Then, taking the average of the remaining five samples we get as the mean result on the R. D. S. scale 745°. We are therefore fully justified in adopting as a fair standard that which we have deduced from other considerations, namely, 763° *on the Royal Dublin Society scale for a sample of bone superphosphate costing the farmer not more than £8 per ton.*

Having, I hope, shown that the existing system of valuation of superphosphates may be replaced with advantage by another capable of yielding results of higher accuracy and practical value, and having fixed certain standards, by reference to which these artificial manures can be adjudicated upon with fairness alike to the vendor and the farmer; I ought to give notice that all superphosphates sent to the Royal Dublin Society for analysis must now be valued on the above plan.

In concluding this paper I may venture to express the opinion that much public advantage would accrue if the Royal Dublin Society offered some inducement to dealers in superphosphates to compete, on the understanding that the best sample offered at a given price to the farmer should be used as a standard for reference during the season immediately following the competition. However until some such plan is adopted, I venture to think we may fairly rest content with the standards I have now endeavoured to fix.

ON THE

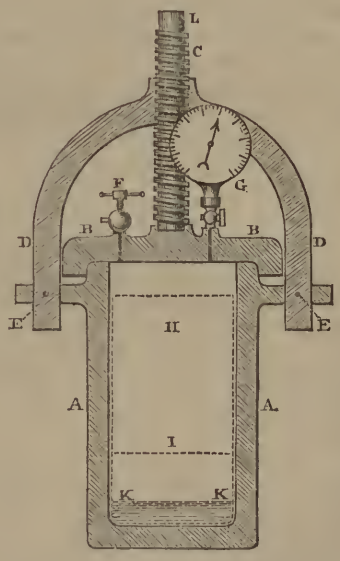
PRODUCTION OF FURFUROL BY THE ACTION OF HIGH-PRESSURE STEAM UPON WOOD.

By GREVILLE WILLIAMS, F.R.S.

(Continued from p. 231).

HAVING shown that furfurol is formed when wood is heated with water to an elevated temperature and pressure, which result has since been confirmed by Mr. Hugo Müller,* I now proceed to give the method by which I found it to be produced by the action of high-pressure steam on the same substance.

The apparatus employed is shown in the engraving. A A is a bronze autoclave, made in one piece, and of great strength. Before being employed it was tested by means of a hydraulic pump, and was found to withstand a pressure of 500 lbs. to the inch without leakage. Before



using the instrument a ring of vulcanised india-rubber was placed between the autoclave and its cover, B B. The screw, C, which serves to keep down the cover, is forced home by means of a wrench applied at L. The arms, D D, serving to support the screw, are affixed to projections on the autoclave, by movable steel pins inserted at E E. A screw-tap, F, enables the product to be distilled over at the conclusion of the operation. The pressures are indicated by the gauge, G. A cylinder of perforated metal, H, is used to contain the substance to be experimented upon; which, in this case, was pine sawdust. The shelf, I, also perforated, prevents contact of the sawdust with the water, the level of the latter being shown at K K.

The water and the charge of sawdust having been introduced, the apparatus was immersed to about half its depth in an oil-bath, the temperature being carefully

regulated by means of a thermometer. The oil-bath was then heated until the gauge indicated a pressure of 100 lbs. to the inch; this pressure was maintained in some experiments for three, and in others for four hours, the average temperature of the oil-bath being about 198° C. The apparatus having been allowed to cool until the pressure had completely gone down, was then connected with a condensing arrangement. The screw, F, was then loosened, and heat was applied to the oil-bath until about three-fourths of the water present had distilled over. The distillate was strongly acid to test-paper, and smelt decidedly of furfurol, mixed with an empyreumatic odour. On the addition of ammonia it acquired a yellow tint, and in a few hours deposited the characteristic crystals of furfuramide. The crude distillate, mixed with aniline and acetic or hydrochloric acid, instantly gave the magnificent crimson colouration indicative of furfurol. To prove that the crystalline precipitate with ammonia was really furfuramide, I distilled it with a very small quantity of hydrochloric acid; the distillate immediately gave the crimson reaction with aniline. The crystals, treated with acetic acid and aniline, also reacted in the same manner.

From the scale upon which the operation was made, the quantity of furfurol obtained was, however, necessarily small.

The arrangement of the apparatus used in this experiment renders it evident that if the furfurol formed was due to the presence of organic acids, they must have acted in the state of vapour. The experiments I have as yet made seem, however, rather to indicate that the furfurol and the acids are formed simultaneously.

Water alone, and steam alone, being therefore capable —at comparatively high temperatures and pressures—of causing the production of furfurol from wood, I next proceeded to ascertain whether that substance would yield furfurol when distilled with water at normal pressures. I therefore distilled 100 lbs. of sawdust with 100 gallons of water, in a still heated by a copper steam coil: 20 gallons were distilled over. These 20 gallons were put into a small copper still, and the first 10 gallons received. These in their turn were rectified again, and two received. In spite of the concentration which these liquors had undergone, I was unable to obtain furfuramide on digestion with ammonia, and, in fact, they only contained minute traces of furfurol. The high temperature, and consequently pressure, are therefore necessary to the reaction, and this fact forbids the supposition that the furfurol might have been formed during the final process of distillation from the autoclave.

Star Chemical Works, Brentford,
December, 1872.

ON THE HISTORY OF OZONE.*

By Professor ODLING, F.R.S.

Concluded from p. 283.

V.

It has just been remarked that in the action of the contracted gas on iodide of potassium solution, there is absorbed by the reagent, with equivalent liberation of iodine, a weight of oxygen corresponding to a volume equal to that of the original contraction; but very curiously, the absorption by the reagent of this weight of oxygen from the contracted gas was found by Messrs. Andrews and Tait not to produce any further contraction or alteration of its volume; or the weight of oxygen which acted on the iodide of potassium solution appeared to occupy no part of the volume of the contracted gas, its removal from the contracted gas by means of the reagent not affecting any alteration in that volume. Since this remarkable result was first announced by Messrs. Andrews and Tait in 1860, it has been adundantly confirmed by von Babo and Claus, by Soret, and by Sir Benjamin Brodie—the modes of experimenting adopted in the original investigation of Andrews and Tait and in the three subsequent investigations, being all different from one another. And moreover, not only has the fact been established by the four several investigations with regard to iodide of potassium, but by one or other of the investigations with regard also to iodine, to mercurous salts, to ferrous salts, to arsenites, and to ferrocyanides. So that, when a given volume of ozonised oxygen is allowed to act upon these different oxidisable bodies, the oxidation effected by the ozone present in the gas is found to be unattended by any diminution in the volume of the gas. An interpretation of this singular result was put forward by the speaker soon after the publication of Messrs. Andrews and Tait's experiments, to the following effect:—Ozone being proved to be a condensed form of oxygen, it is clear that any volume of ozone will contain a greater weight of the matter of oxygen than is contained in the same volume of ordinary oxygen. And since in the action of ozone upon iodide of potassium, the volume of the reacting gas does not undergo any alteration, it is obvious that the oxidation effected must be effected by only so much of the matter of oxygen contained in the volume of ozone as is in excess of the matter of oxygen contained in the same volume of ordinary oxygen. This interpretation, so far as it went, was considered to be demanded by Messrs. Andrews and Tait's experiments, as the only satisfactory explanation of them. With regard to the weight of the matter of oxygen contained in a given volume of ozone, in excess of the weight of the matter of oxygen contained in the same volume of ordinary oxygen, no data whatever existed to show what this weight really is. But relying upon the fact that the weight of oxygen contained in a standard volume of free oxygen is composed of two simple weights of the matter of oxygen, it was conjectured that the weight of oxygen contained in a standard volume of ozone might not improbably be constituted by an introduction into the standard volume of ordinary oxygen of another simple weight of oxygen—equal volumes of ozone, free oxygen, and nitric oxide, for example, being expressible by the comparable formulæ O_3,O_2, and NO respectively. In accordance with this supposition, the action of ozonised gas upon iodide of potassium, &c., is explicable as follows:—The ozone which acts is decomposed into a weight of free oxygen equal in volume to the volume of the ozone, and into another weight of absorbed oxygen, assumed to be one-half of the former weight. The suggestion as to the standard volume of ozone being constituted thus of three simple weights of the matter of oxygen, was admittedly not a necessary deduction from the then known facts, which were indeed equally consistent with its being constituted of four, five, or six such weights; it was only the suggestion of the simplest possible constitution for ozone that was consistent with the facts.

A few years afterwards, in 1865-66, the probability of this being the real constitution of ozone was much strengthened by the results of some experiments conducted by Soret. Operating by a process very simple and ingenious, but scarcely calculated to afford precise results, Soret found that when electrolytically obtained ozonised oxygen was allowed to act upon oil of turpentine, the absorption of the ozone by the turpentine was attended by a diminution in the volume of the gas equal approximatively to twice the initial contraction,—as inferred, of course, from the iodine-titre of the ozonised gas, or from its permanent expansion after exposure to a temporary heat. Supposing the final diminution effected by the turpentine to have been exactly twice the initial contraction, inferred from the iodine-titre, it is clear, that while the original gas would have suffered altogether a diminution of three volumes, the ozonised gas would have suffered a diminution of only two volumes. Or there would have been ultimately abstracted from the original uncontracted

* Read before the Royal Institution of Great Britain.

gas three volumes of the matter of oxygen, occupying in the contracted or ozonised gas, submitted to the action of the turpentine, only the bulk of two volumes. But as a mean result of Soret's first set of five experiments, the final diminution effected by the turpentine was 2·40 times the original contraction; while, as a mean result of his second set of seven experiments, the final diminution was 1·81 times the original contraction. Assuming, however, ozone to have the constitution expressed by the symbol O_3, its specific gravity, and consequently its diffusion-velocity, would approximate closely to the specific gravity and diffusion-velocity of carbonic acid gas, CO_2; and in 1867, Soret, in corroboration of his previous absorption results, satisfied himself that the diffusion-velocity of ozone really does approximate very closely to that of carbonic acid.

VI.

During the last few years, the quantitative reactions of ozone have been made the subject of an elaborate study by Sir Benjamin Brodie, whose results constitute indeed "a body of exact information as to the chemical properties of ozone, through which it may be hoped that this important question will be finally removed from the domain of arbitrary speculation and brought within the precincts of science." In Brodie's experiments, a quantity of pure perfectly dry oxygen, after having been submitted to electrisation by its passage through a modified form of Siemens's induction tube, carefully maintained at a low temperature, was collected in an oil of vitriol gas-holder, to the amount of four or five thousand c.c. From the store of ozonised gas thus collected, which was found to maintain its proportion of ozone without appreciable deterioration for some hours, portion after portion was allowed to pass into a pipette of about 250 c.c. capacity, by displacement of the oil of vitriol originally filling it; and successive equal volumes of the store of ozonised gas so measured off, were submitted one after another to the action of the same or of different reagents, by the passage of each pipetteful of gas through a small bulb-tube containing the reagent in solution. The gas, freed from all ozone by its passage through the reagent, was next received into a mercurial measuring cylinder, in which it was expanded to a definite volume; and then, by reading off the pressure at which it occupied this volume, its proper volume was ascertained. Finally the difference between the capacity of the pipette and the volume obtained in the mercurial cylinder showed the volume of the gas absorbed by the reagent,—the weight of this gas being determined directly or indirectly by titrations of the reagent. Of course, very many points of detail in the construction and use of the apparatus had to be attended to, in order to ensure trustworthy results; but, both in its principle and general working, the process is exceedingly simple. One essential novelty consists in the application of that very useful instrument, the pipette, to the purposes of gas analysis; and by its aid, results having a degree of accuracy far greater than those furnished by any previous method of ozone investigation, were found to be obtainable with both speed and facility.

Operating, then, with the apparatus just described, Brodie has succeeded in established three perfectly definite classes of ozone reactions,—the first of them including the instances previously made known by Andrews and Tait. In this first class of reactions, of which there are several distinct varieties, the absorption or decomposition of the ozone present in a mixture of ozone and oxygen, is unattended by any diminution in the volume of the gas; or a volume of ozone O^{2+x}, is resolved into an equal volume of free oxygen, and an indefinite weight of other oxygen, either absorbed or set free. This class of reactions accordingly does not afford any information as to the value of x, or, in other words, as to the relationship of the formula O^{2+x} to the formula O^2.

Unit-vols.

$$\overbrace{O^{2+x} = O^2 + xO}\ \text{absorbed.}$$

In a second class of reactions, the absorption or decomposition of the ozone present in a mixture of ozone and oxygen is attended with a diminution in the volume of the gas, equal to half the volume that the weight of oxygen absorbed would occupy in the free state. In this class of reactions, then, one of but two occurrences must happen: either the ozone present in the mixture of gases is absorbed wholly without decomposition, in which case the density of ozone must be twice that of ordinary oxygen, and the formula O^{2+x} become O^4; or the ozone present in the mixture is decomposed into half its volume of oxygen liberated, and into a quantity of oxygen, corresponding to its entire volume, absorbed; in which case the density of ozone must be one and a-half that of ordinary oxygen, and the formula O^{2+x} become O_3.

Unit-Volumes.

$$\left.\begin{aligned}\overbrace{O^{2+x} &= nil} + 4O\\ 2(O^{2+x}) &= O^2 + 4O\end{aligned}\right\}\ \text{absorbed.}$$

In a third class of reactions, the absorption or decomposition of the ozone present in a mixture of ozone and oxygen is attended with a diminution in volume of the gas, equal to two-thirds the volume that the weight of oxygen absorbed would occupy in the free state; or the weight of the gas absorbed is to the weight of an equal volume of oxygen as 3 to 2. But consistenly with this class of reactions, the density of ozone must necessarily be one and a-half times that of ordinary oxygen, and the formula O^{2+x} must become O^3.

Unit-Vols.

$$\overbrace{O^{2+x}) = nil} + 3O.$$

This last and most important class of reactions, by which the formula of ozone as O^3 is put beyond question, was established by a long series of experiments, made chiefly with a neutral or but slightly alkaline solution of hyposulphite of soda, and in a few cases with oil of turpentine. As a result, the ratio of the entire diminution in volume suffered by the original oxygen, to the diminution in volume of the electrised or contracted oxygen effected by the reagent, was found to be, as a mean of twenty-seven concordant experiments made with the hyposulphite, 3·02 to 2·02; and as a mean of eight concordant experiments made with the turpentine, also as 3·02 to 2·02. But neither with the hyposulphite nor with the turpentine could the weight of oxygen absorbed by the reagent be determined, otherwise than by a calculation from the alteration in volume of the gas. A direct determination, however, was effected in the case of a few experiments made with protochloride of tin, under conditions carefully considered and regulated so as to ensure a trustworthy result. And it was found, in these few experiments, that the weight of the matter of oxygen absorbed from the ozonised gas by the tin salt, was almost exactly three times the weight of the matter of oxygen absorbed from the same gas by iodide of potassium,—the volume occupied by the weight of oxygen absorbed by the tin salt being almost exactly twice the volume proper to the weight of oxygen absorbed by the iodide of potassium.

Independently of the importance attaching to the actual determination of the density of ozone, Sir B. Brodie's result has a further interest for chemists, which it would be difficult to exaggerate. The principal of the elementary bodies, known to chemists in the gaseous or vapourous state, are hydrogen, chlorine and its congeners, oxygen, sulphur, nitrogen, phosphorus, arsenic, mercury, and cadmium. Now it is a fact that the weight of phosphorus or arsenic contained in any volume of phosphorus or arsenic vapour is four times the weight of phosphorus or arsenic contained in the same volume of phosphoretted or arsenetted hydrogen, and of a host of other phosphoretted or arsenetted gases or vapours. It is also a fact that the weight of hydrogen, chlorine, oxygen, or nitrogen contained in any volume of each of these elementary gases, is twice the weight of hydrogen, chlorine, oxygen, or

nitrogen contained in the same volume of a variety of hydrogenous, chlorinous, oxygenous, or nitrogenous compound gases. It is also a fact that the weight of mercury or cadmium contained in any volume of the vapour of either element is identical with the weight of the element contained in the same volume of the vapour of all its hitherto examined volatile compounds. But now a variety of oxygen is shown to exist, the weight of any given volume of which is three times the weight of oxygen contained in the same volume of the simplest of oxygenous compounds respectively, thus :—

Unit-Volumes.

P_4	O_3	O_2	Hg
PCl_3	CO	NO	$HgCl_2$.

The question, then, naturally arises, how long will it be before another variety of oxygen is recognised, the weight of any given volume of which, like that of a given volume of phosphorus vapour, shall furnish the weight of the element contained in four such volumes of its several simplest compounds? And again, how long will it be before yet another variety of oxygen is recognised, the weight of any given volume of which, like that of any given volume of mercury vapour, shall furnish but the weight of the element contained in the same volume of its several simplest compounds? There is the strongest indirect reason for believing in the existence of such a unitary oxygen. For in its reactions, oxygen behaves as a sort of more active electro-negative counterpart of electro-positive mercury Hg; and like mercury, Hg, and unlike hydrogen, H_2, and chlorine, Cl_2, it enjoys the property of adding itself to a pre-formed unit of substance by an indivisible proportion.

PASSAGE OF HEAT RAYS THROUGH INCLINED DIATHERMANOUS PLATES.

(Concluded from p. 269).

IN the first part of Professor Knoblauch's paper, the influence of polarisation of heat rays is investigated, apart (as much as possible) from the absorbent nature of the plates. The latter influence falls now to be considered.

A series of experiments are detailed, in which glasses of various colours were employed, the number of plates and angle of incidence being varied several times for each. The more prominent results from this part of the enquiry are these:—

(1). Where parallel heat rays fall on parallel diathermanous plates (varying in number), and where, with perpendicular incidence, the quantity of heat transmitted through different numbers of plates, is, through a special arrangement made in each case, the same; then, on varying the angle for any one number of plates, the heat transmitted is less, and this in proportion as the substance is less diathermanous. This occurs also whether the heat rays are unpolarised, or polarised, in any plane. For the same angle of incidence and the same number of plates, the transmission, as indicated by the multiplier, was greatest with colourless glass, smaller with yellowish green, still smaller with blue (bright blue giving more than dark), and smallest with bluish green glass.

(2). When the incident heat is unpolarised (or polarised at 45°), then, through the partial polarisation which is produced on refraction in the plate (and the plane of which is at right angles to the plane of refraction), the decrease, due to absorption in the aforementioned case, is at first prevented more or less in proportion as the substance of the plate is more or less diathermanous; but a very much faster decrease of the heat appears after the angle of polarisation is passed. Thus, with colourless and yellowish green glass, the heat intensity continued constant till the angle of incidence, 55°; with the bright blue till 25°; whereas with dark blue and bluish green a decrease began at 15°, and this increased greatly after 55°.

(3). When the heat rays were perfectly polarised before entrance into the plate, and the planes of polarisation and of refraction coincided, then, with increasing incidence and number of plates, the transmission was diminished, but the diminution was greater than in the previous case, and also greater the less diathermanous the substance of the plates.

(4). On the other hand, when the original polarisation was such that the planes of refraction and polarisation crossed at right angles, then, till the angle of incidence exceeded the angle of polarisation, there was not only no decrease of the transmitted heat, but a positive increase, and this was the greater in proportion as the plates were more diathermanous. Sometimes the maximum transmission was reached before the angle of polarisation. When this angle was passed, the decrease which took place was always less than in the case of unpolarised rays. The increase of the plates favoured the increase now referred to, and this influence is more marked the more diathermanous the substance, till continued increase of the angle of incidence and number of plates produces decrease of transmitted heat.—*Pogg. Ann.*

A. B. M.

THE QUANTITATIVE ESTIMATION OF MANGANESE IN SOILS AND IN THE ASH OF PLANTS.

By A. LECLERC.

THE ordinary gravimetrical methods of estimating manganese in soils and in the ashes of plants are not sufficiently correct to yield good and reliable results, unless, indeed, a very large quantity of material is operated upon at the same time.

The method which I propose and expound in this paper is a volumetrical one, which may be rapidly, yet accurately, performed. The plan consists in the conversion of nitrate of manganese into a permanganate, and the titration of the latter by means of a suitable solution. The conversion just mentioned is readily effected by the aid of red-lead, because the iron and aluminium, the only substances which could react upon the permanganate, are at the time of the conversion already peroxidised. The reaction alluded to will always succeed, provided there be no chlorine present in the substances employed.

Before detailing the quantitative operation, it is necessary to describe the practical details of the experiments. When a soil (arable or other) is to be operated upon by nitric acid, it is first necessary to destroy the organic matter it contains by igniting the soil to red heat. It is next boiled with nitric acid, care being taken not to evaporate the solution to dryness, since, owing to the fact that the nitrate of manganese is decomposed, at 142°, into MnO_2, which is insoluble in nitric acid, manganese might be lost. When the nitric acid appears to have taken up all the manganese, the liquid is filtered, and then diluted with water up to a given and determined bulk. A fraction of this fluid, viz., that in which the chlorine has been estimated by means of nitrate of silver, is next boiled in a porcelain capsule, and after boiling, some red-lead is added, care being taken to stir the fluid. The result is, that the fluid assumes a beautiful violet colour, due to permanganate of potassa, the colour being somewhat masked by that of the peroxide of lead, which is simultaneously formed and deposited in insoluble condition. The depth of the violet colouration depends upon the greater or less amount of manganese present. If it should happen that the red-lead be not acted upon, it is due to the liquor not being sufficiently acid, and consequently some more nitric acid will have to be added. The peroxide of lead having been precipitated, the liquor is filtered through asbestos free from chlorine. The filtrate is then ready for titration, the liquid containing a slight excess of

nitric acid, permanganate of potassa, nitrate of lead, salts of iron, alumina, magnesia, lime, soda, and potassa. Titration by means of the double sulphate of iron and ammonia is out of the question, because the formation of sulphate of lead would prevent the end of the reaction from being seen, and oxalic acid cannot be used, both on account of its giving rise to the formation of carbonate of lead, and because it requires a higher temperature. I therefore looked for another reducing agent which would allow me to observe correctly the change of the violet to another colour; the nitrate of protoxide of mercury I found to answer my purpose in this respect. This salt is rapidly converted into the nitrate of peroxide of mercury by the permanganate, and the end of the reaction is marked either by a yellowish green colouration, when much manganese is present, or by complete decolouration of the fluid if only a little of the metal is present. The solution of subnitrate of mercury does not form any precipitate, unless, indeed, too much manganese were present, but care should be taken that the liquid to be titrated is rather freely acid, because otherwise sesquioxide of manganese is thrown down. The solution of subnitrate of mercury is first titrated by means of permanganate.

Description of the Experiments.

Expt. 1.—50 grms. of soil are treated, as above indicated, with nitric acid, the liquid is filtered, and the filtrate diluted to 1000 c.c. Three titrations, made with 100 c.c. each, have, on an average, given the following results:—3·39 c.c. of subnitrate of mercury (1 c.c. thereof = to 1·121 m.grm. of Mn), corresponding to $1{\cdot}121 \times 3{\cdot}39 = 3{\cdot}8102$ of manganese. 50 grms. of the same soil, to which have been first added 10 c.c. of a titrated solution of permanganate (this liquid containing 2·366 m.grm. of manganese to the c.c.) have been treated in the same way, and five titrations, made with 100 c.c. each, have given, on an average, 5·51 c.c. of subnitrate used, corresponding to $1{\cdot}121 \times 5{\cdot}51 = 6{\cdot}1767$ m.grm. of manganese. According to these estimations, there would be an increase of $6{\cdot}1767 - 3{\cdot}8102 = 2{\cdot}3665$ of manganese, corresponding to the quantity added, for 100 c.c., to the soil in the shape of permanganate. We have therefore—

Manganese found by analysis	2·3665 m.grm.
Manganese added..	2·3660 ,,
Difference, an excess of	0·0005 ,,

Expt. 2.—5 grms. of ash have been treated in the same way as the soil. The filtrate having been diluted to 500 c.c., the titrations made with 50 c.c. give an average of 14 c.c. of subnitrate used, corresponding to—

$1{\cdot}121 \times 14 = 15{\cdot}694$ m.grm. of manganese.

To 5 grms. of the ash have been added, after treatment with nitric acid, 5 c.c. of permanganate (5 at 11·830 m.grm. Mn); the filtrate having been diluted to 500 c.c., the average of the titrations made with 50 c.c. shows that 15·055 c.c. of subnitrate of mercury have been used, corresponding to $1{\cdot}121 \times 15{\cdot}055 = 16{\cdot}8766$ m.grm. of manganese. Accordingly there is an increase of manganese for $16{\cdot}8766 - 15{\cdot}694 = 1{\cdot}1826$ m.grm. of manganese, a quantity corresponding, for 50 c.c., to that added to the ash, and we have therefore—

Manganese added..	1·1830 m.grm.
Manganese found	1·1826 ,,
Difference, *minus*	0·0004 ,,

The author adds to this paper a very extensive tabulated form, showing the results of a series of experiments made with various soils of different geological formations, from which it appears that the method above-mentioned yields very accurate results. We do not here give this tabulated form, because the figures quoted relate particularly to French soil, but as instances we quote the following figures:—

	Mn_2O_3, per cent.
Alluvial soil (Toulouse)	0·078
Granite (Remiremont)	0·060
Chalk formation (Yonne)..	0·276
Sandstone (Vosges) varies from	0·037 to 0·1860
Ashes of plants—	
Oak	1·4880
Fir tree..	4·5070
Lime tree	3·7440
Vine (stem)..	0·1910
,, (root)	0·1300
Grain—	
Wheat	0·0113
Rice	0·0010
Pulverised bones	0·0061
,, coprolites..	0·1460

The theory of the method above described is exhibited by the following formula—

$$Mn_2O_7,KO + 4Hg_2O,NO_5 + 5NO_5 = \\ = KO,NO_5 + 8HgO,NO_5 + Mn_2O_3.$$

The supposition of the precipitation of Mn_2O_3 has been verified by experiment. The precipitate, on being tested after titration, has been found to be sesquioxide of manganese.—*Comptes Rendus.*

MINERALOGY.

The third lecture of the series, by W. W. Smyth, F.R.S., on Monday evening, November 25, was on "Silica, or Quartz and its Varieties."

The term crystal (from the Greek *crystallos*, ice) was first applied to crystal of quartz or rock crystal; which was regarded as a variety of ice. It belongs to a class of minerals characterised by having silica for their chief constituent, and of which it is the purest variety. Its crystals belong to the hexagonal system, quartz crystals usually assuming the form of a six-sided prism, terminated at both ends by a six-sided pyramid. The largest and most beautiful crystals are from Madagascar. The substance is extremely hard, and cannot be scratched by steel, and can only be worked by taking advantage of its brittleness. The substance used for "pebble spectacles" and "pebble lenses" is crystalline quartz, brought chiefly from Brazil; and is valuable for these purposes not only on account of its transparency, but especially on account of its coolness. A less crystalline variety is known as common quartz, and is exceedingly interesting as being in many cases the matrix in which gold is found in the mining districts. Some fine specimens of this auriferous quartz from California and Australia may be seen in the Geological Museum.

The lecturer exhibited a fine specimen of quartz to illustrate the phenomenon of pseudomorphism, which was full of casts of crystals of cubic and rhombohedral form, in the latter of which forms quartz is very seldom found crystallised, and never in the former. He explained their origin by supposing the quartz to have been deposited round crystals of some other materials (*e.g.*, in veins) which have since been removed. Quartz is very frequently found filling up fissures in the rocks, or forming veins, and in some of these veins valuable mineral ores are found, for example, the tin ores of Cornwall. Galleries are driven in the rocks, and the whole of the material in the productive veins removed with the exception of bars at various levels, left as floors and to prevent the side walls from collapsing. Many serious accidents have occurred by the giving way of these masses, both in California and in our own country. If any circumstance has prevented the quartz from attaining its proper degree of coherence and hardness, or if any impurity is present (*e.g.*, a thin layer of clay) to destroy its continuity, it is quite unsafe to work underneath these galleries.

Jasper is a variety of quartz of a red, brown, or greenish tint. Caerngorm is another variety which is obtained from the mountain of that name in Scotland. "Smoky quartz" is so named from its smoky appearance; and "rose quartz" from its tint, which is due to the presence of a metallic oxide. Amethyst likewise belongs to the quartz family of minerals, and has a beautiful purple tint. It owes its name to a strange fancy regarding it in olden time, namely that the wearer of it was preserved from inebriation. Under the term "agate" a large number of minerals are arranged, which agree in being made up of layers or bands of material, coloured more or less distinctly. They are often found wholly or partly filling up the hollows of certain cavernous substances, and appear to have been deposited from solution in water. If the layers are strongly contrasted, as black and white, the name onyx is given to it, and if in addition to these a reddish layer is present it is called sardonyx. Avanturine is a brownish mineral containing numerous little plates of mica, which act as so many spangles in reflecting the light.

Calcedony (of which certain stalactitic forms are known) carnelian and sard also belongs to this class. With respect to sard, the lecturer took occasion to call attention to those exceedingly beautiful "engraved gems," which he characterised as examples of the highest art-workmanship of antiquity which has come down to us. The beautiful polish which the substance is capable of taking, and its great durability, made it to be much valued by ancient lapidaries. And both these qualities rendered it and allied substances well fitted for cutting into signet rings, which in those times were objects of such common use.

In the form of sandstones quartz is in common use for building proceses. It has been reduced to this form by the action of the waves and other agencies, and can be easily worked and split up into flagstones, &c.; sometimes sufficiently thin as to be used for roofing materials. Grit is a coarser form of a similar nature; and a coarser still is known as "plum-pudding stone."

An amorphous variety of quartz minerals, containing from 4 to 7 per cent of water, is termed opal. This is one of the most interesting varieties of the family, as showing the probable mode of their formation. It appears to have been deposited from water, and in some cases, as at Antigua in the West Indies, and in Hungary, trunks of trees and pieces of wood are found completely opalised. Noble, or precious opal, is found in Hungary very near to places where the mineralised wood occurs.

In Iceland and New Zealand, at the present day we see an example of siliceous matter being deposited from hot water. The orifices of the Icelandic geysers are surrounded by basins composed of this siliceous sinter, which is likewise deposited on materials placed in the water. The lecturer had a specimen of a stick thus silicified in the water of these springs. He had also an illustration of a very curious mode of rock formation by means of hot springs in North Island, New Zealand, which consists of a natural cascade formed entirely from the siliceous matter deposited from boiling springs. The various steps of the cascade were circular or basin shaped, and were all seen to be overflowing with water. In conclusion he said that probably these hot mineral springs had been the chief agency in filling up the veins in the rocks.

"Silicate Minerals and the Silicate Gems" was the subject of the fourth lecture of the course by W. W. Smyth, F.R.S., delivered at the Geological Museum on Monday evening, December 2nd.

Silicates are substances which contain a large amount of silica (a compound of silicon and oxygen), and of these there are numerous varieties. Some are hydrous, others anhydrous; to the latter class the lecturer proposed to confine his remarks. Gems are mineral substances having an agreeable tint of colour, a certain amount of transparency and brilliancy, and especially a great degree of hardness, enabling them to retain their forms and features for ages; besides the above qualities, rarity is to a certain extent an element in their value. Beautiful substances, wanting more or less the high degree of hardness, were admitted by the Ancients as half-gems.

Amongst the very complicated minerals (as regards their composition) of this class, *chrysolite* is one of the most simple. This term is applied chiefly to large yellowish green crystals of the substance; to the darker green varieties the name *peridote* is given; while, under the name of *olivine*, the substance is found disseminated throughout many rock masses, especially the basalts (as those of Fingal's Cave, Giant's Causeway, &c.), and also in meteorites. In meteorites from the desert of Atacama, crystals of chrysolite are found. The average chemical composition of this and other minerals of the same class is given in the following table:—

	$\ddot{Si}$.	$\ddot{Al}$.	$\dot{Fe}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{Na}$.	$\dot{K}$.	
Felspar (Adularia)	65·69	17·97	—	—	1·34	1·01	13·99	Mn
Ditto (Amazon stone)	65·32	17·89	0·30	0·09	0·10	2·81	13·05	0·19
			$\dot{Fe}$.			$\ddot{Cr}$		
Chrysolite	40·12	0·14	15·32	44·54	—		—	0·29
Garnet (Bohemia)	42·08	20·00	1·51	10·20	1·99	3·01	—	0·32
						Beryllia.		
Beryl (Ural)	67·00	16·50	1·00	—	0·50	14·50	—	—
Emerald (Muzo)	68·50	15·75	1·00	Fl	0·25	12·50	0·50	—
Topaz (Brazil)	34·24	57·45	—	15·06	Zirconia.	—	—	—
Zircon	32·00	—	2·00	—	64·5	—	—	—

Felspar is now employed as a family name for a series of minerals. *Orthoclase* is one of these, which, as the name implies, cleaves with right angles. *Adularia* is another variety, named from Aduli, a mountain in Switzerland; its formula is—

$$\ddot{Al}\,\ddot{Si}_3 + \dot{K}\,\ddot{Si}.$$

One variety of adularia, from its peculiar luminosity, is known as *moon-stone*; and a green variety, from Siberia, as *Amazon-stone*. The porphyries are a peculiar class of rocks containing more or less distinct crystals of various substances in the different varieties; in some districts they are worked as building-stones. A schorlaceous variety, met with only in one district in Cornwall, was employed as the material for the sarcophagus of the Duke of Wellington. Under certain circumstances, felspathic rocks are decomposed, and form the substance known as "kaolin," or "China clay," so largely used by the Chinese for making the finer kinds of porcelain, and, since its discovery in Cornwall and Devon in the last century, applied to the same purpose in this country.

One of the most common of the silicate gems is the *garnet*, which occurs in crystals of large size in many countries. It crystallises as a rhombic dodecahedron, icositetrahedron, and other allied forms, and its formula, in the variety known as *grossularia*, is—

$$\dot{Ca}_3\,\ddot{Si} + \ddot{Al}\,\ddot{Si}.$$

The term garnet is, by jewellers, confined to those stones cut into facets; other specimens of the same mineral, of a deep red colour, when cut *en cabochon* (a jeweller's term to denote a form with rounded faces, or concavo-convex), are known as *carbuncles*. Crystals of it are found in Scotland, but it occurs most abundantly in Hungary, where it is found (especially after floods) in the gravel of rivers. As an example of its abundance there, the lecturer stated that he had bought garnets by the pint from persons in the streets, and that the people there use the small garnets, in the same way as sand is used in some countries, to dry their writing instead of blotting-paper. The *topaz* is another gem of this series, having a crystalline form, in many cases of a four-sided prism terminated

by a rhomb, and with the property of cleavage well developed in directions parallel to the two ends of the crystal. The cleavage-planes are the smoothest and most brilliant faces of the crystal in its natural state, the sides of the prism being minutely striated, and by these simple properties this gem may be distinguished from several other substances which in some respects closely resemble it. It is found in Siberia, in Brazil, and on a small scale in our own islands at St. Michael's Mount, in Cornwall, and in the Mourne Mountains, in Ireland. A very fine collection of specimens from Siberia is now in the British Museum, having been purchased from a Russian officer, Colonel de Kokscharow; they have, however, to be covered with close-fitting caps, to exclude the light, which would prove injurious to their colour. It has generally a yellowish tint, but is sometimes colourless; the pink varieties are artificialy produced by exposure to heat. Its chemical formula is given as—

$$\dddot{\mathrm{Al}}\,\dddot{\mathrm{Si}} + (2\mathrm{AlF_3} + 3\mathrm{SiF_2}).$$

The gem known to the Ancients under this name appears not to have been the same as that to which we give the name "topaz," but perhaps the crysolite.

The mineral called *beryl*, which includes amongst its varieties the emerald and the aquamarine, crystallises principally in a six-sided prism with flat terminations, but often these terminal planes are replaced by other forms. Its formula is—

$$\dddot{\mathrm{Al}}\,\dddot{\mathrm{Si}} + \mathrm{BeSi},$$

and the percentage composition of two varieties is given in the table above. Beryl occurs as a greenish, bluish, or greyish mineral, either opaque or translucent; its finest green varieties are known to us as "emerald," while a paler species is termed "aquamarine," as bearing a fancied resemblance in colour to sea-water. As *emerald*, it is very highly valued, and the Ancients were very high in their praises of it; though there is very much difficulty in ascertaining the exact locality whence they obtained it, there is reason to believe that some specimens were from a district in Upper Egypt. Their strange traditions about its being jealously guarded by griffins are capable of a probable rational explanation. They also probably confounded, in many instances, a very different mineral, known as "copper emerald" (having a similar appearance), with the genuine stone; and, indeed, the inferior mineral is now sometimes mistaken and offered for sale as real emerald. The finest emeralds of the present day are brought from Muzo, a district in New Granada, where it is found imbedded in a black limestone. A very fine cylindrical specimen of this gem is set in the tiara of the Popes.

NOTICES OF BOOKS.

A Practical Treatise on Pure Fertilisers, and the Chemical Conversion of Rock Guanos, Marlstones, Coprolites, and the Crude Phosphates of Lime and Alumina generally, into Various Valuable Products. By Campbell Morfit, M.D., F.C.S. London: Trübner and Co.

The need of a thoroughly practical work on the manufacture of chemical manures has long been felt. We are happy to find that the deficiency has been supplied by Mr. Campbell Morfit, a chemist who has for years directed his attention to this important subject. It is interesting to find that the author pronounces the sewage of towns to be the true manure, and regards "superphosphate" and similar preparations as mere temporary substitutes, to be laid aside as soon as the great sewage question is thoroughly solved. This solution, we are happy to find, he seeks not in "irrigation," but in "precipitation."

Mr. Morfit points out clearly the defects attending the ordinary system of rendering phosphatic minerals soluble. Commercial "superphosphate," he shows, contains more or less of the raw material in an unconverted state, along with a variable amount of free acid. Its greatest possible proportion of soluble phosphate is 32 per cent, whilst in ill-made and adulterated samples this constituent may fall as low as 10 or 15 per cent. The phenomenon known as "going back," so unpleasant both to producers and consumers, he ascribes to the presence of unconverted material. "It is the undecomposed portion of tri-phosphate of lime," he observes, "which exists almost invariably in the ordinary commercial superphosphates, that causes the biphosphate portion to 'go back,' according to trade language, or become directly insoluble in water."

In place of these superphosphates the author recommends "precipitated phosphate," "Columbian phosphate," diphosphate, chlorophosphate, and sulphited phosphate. The processes for preparing these fertilisers, as directed by Way, Deligny, Gerland, and the author himself, are clearly described, with the addition of diagrams of the machinery and plant required, drawn to scale. For Gerland's "sulphited phosphate" he claims a very high rank as a disinfectant and deodoriser, and points out the ease with which it can be manufactured in regions where acids are not procurable. In its production he tells us—"Sulphuretted ores may be substituted for sulphur; and this means of concentrating them, by roasting, for more economical transportation to distant markets or smelting-works, opens a way for the profitable production of the sulphite of tri-phosphate of lime in those remote places where crude phosphate material abounds, and sulphuric acid is to be obtained only at a cost which is too great for its employment in the usual processes of manufacturing fertilisers."

It must, however, be admitted that to introduce these "pure fertilisers" into the market will be a work of time and of difficulty. One reason why so many low-class manures are made and sold is the outcry for cheapness. Double the strength of your product, and you will not always find it practicable to obtain double the price.

The author furnishes a list of normal fertilisers adapted for different crops, which may, we think, be advantageously studied alike by manure manufacturers and farmers.

In his valuable sections on the analysis of manures and phosphatic minerals, Mr. Morfit makes a remark which cannot be too widely circulated:—"The phosphoric acid is thus shown in its individual combinations, and not totalised as tri-phosphate of lime, according to the meretricious style of 'commercial' chemistry."

Without declaring ourselves satisfied with every view advanced in these pages—especially as regards the cost of producing manures—we can conscientiously recommend the work to the careful study of all our readers who are interested in the application of chemistry to the oldest and most important of the arts.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, December 9, 1872.

In addition to papers relating to mathematico-physical and natural history sciences, this number contains the following original papers and memoirs relating to chemistry:—

Observations on some Groups of Isomeric Substances Derived from the Fermentation Alcohols.—I. Pierre and E. Puchot.—This exhaustive essay, elucidated by a large number of

formulæ and tables, contains a comparative review of the boiling-point, sp. gr. at 0°, sp. gr. at the temperature of ebullition, and other physical characters of several groups of centesimal isomeric bodies derived from fermentation alcohols. It appears that there is a great difference of properties among this group, while in the *isomères par réciprocité* there is scarcely any difference at all.

On Dibenzyl-dicarbonic Acid.—A. P. N. Franchimont.—This essay records in the first place the results of experiments made for the purpose of obtaining an acid of the following constitution:—

$$C_6H_5-CH(CO_2H)_2;$$

but this not having succeeded, another mode of experimenting was adopted with the result that by a complex process the author prepared an acid, the empirical formula of which is $C_8H_7O_2$. This is a solid crystalline substance, fusing at 222°, readily soluble in alcohol, and forming with that fluid an ether which is also a solid body. The constitutional formula of the acid is—

$$\begin{matrix} C_6H_5-CH-CO_2H \\ | \\ C_6H_5-CH-CO_2H. \end{matrix}$$

Splitting into Two (dédoublement) of Hydrate of Chloral by the Joint Action of Glycerine and Heat.—H. Byasson.—In the first portion of this paper the author reviews his former researches on this subject, and next gives details of the results of experiments made to ascertain whether, considering that hydrate of chloral contains the elements of chloroform and formic acid—

$$(C_4HCl_3O_2,H_2O_2=C_2HCl_3+C_2H_2O_4),$$

it would not be possible to split up the body by the aid of glycerine and heat into chloroform and formic acid; the result is that at a comparatively low temperature, beginning at 110° and continuing up to 230°, there is formed chloroform (on an average 31 per cent for the quantity of hydrate of chloral operated upon) and formiate of allyl boiling at between 83° and 85°, sp. gr. 0·934. Very concentrated glycerine is required to be used in this experiment.

Note on Parathionic and Thioamylic (Isomeric with Sulphoamylic) Acids met with in the Mother-liquor of Coralline.—A. Commaille.—The mode of preparation of parathionic acid is first minutely described; this acid as obtained by the decomposition of the lead salt, is a syrup-like fluid, which is neither precipitated by baryta water nor by solution of acetate of lead. The formula of the crystallised lead-salt is $C_4H_5O_7S_2,PbOHO$. The thioamylic acid, also obtained by the decomposition of its lead-salt, is a crystalline substance, very deliquescent; soluble in water and alcohol in every proportion. The formula of the lead-salt of this acid is—

$$C_{10}H_{11}O_7S_2,PbO,HO.$$

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 18, 1872.

This number contains the following original papers and memoirs:—

Ethyl-Cyanocarbonate (Cyan-Kohlensaureäther).—L. Henry.—After briefly referring to the labours of Pinner and Dr. Weddige on this subject, the author quotes some phrases from a paper published by him in the *Comptes Rendus*, vol. lxxi., pp. 314—318, with the view to prove that he has, previous to the above-named authors, obtained the ethyl-cyanocarbonate, but not in sufficiently pure state for further research. The author does not, however, wish this communication to be understood as in the least impairing Dr. Weddige's just claim to the discovery of the compound.

Ethyloxy-Oxalylchloride.—L. Henry.—In the introduction to this exhaustive essay, copiously elucidated by complex formulæ, the author discusses the reactions of the acid chlorides—

$$(C_nH_{2n+1}).CO-\text{-}-Cl,$$

upon the organic zinc compounds, $(C_nH_{2n+1})_2Zn$; and next a discussion follows on the probable results of the behaviour of ethyloxy-oxalylchloride, $C_2H_5O-\text{-}-CO-\text{-}-CO-\text{-}-Cl$, with the zinc compounds referred to. The author further describes at length a series of results of researches; but, owing to the fact that the details would require the reproduction of a large number of complex and lengthy formulæ, we do not enter into further particulars.

Meta-Toluylic Acid.—R. Fittig.—After referring to the researches of Ahrens, Tawildarow, Wurtz, and Richter on this subject, and pointing out the discrepancies of the fusion-point observed by these authors for this acid, the author describes at great length the process by means of which he has prepared perfectly pure meta-toluylic acid, which was found to be slightly soluble in water, to fuse at 105°, and to be distinguished from the ortho- and para-toluylic acids by greater solubility of the calcium salt. This essay further contains the record of researches made, at the author's request, by W. Ramsay, with the view of elucidating the cause of the discrepant results obtained by the above-named authors.

Formation and Decomposition of Formic Acid.—J. Thomsen.—This monograph is a critical review of the labours and researches of Berthelot's thermo-dynamical investigation of this subject. The main conclusion derived from the researches here described is the following:—The thermical behaviour of formic acid exhibits no anomalies; that it is evident that the formation of this from oxide of carbon and water, as well as from hydrogen and carbonic acid, must be accompanied by the evolution of heat, even if hydrate of soda is not present; further, that the phenomena of the decomposition of this acid are not anomalous; and that, lastly, the results of Berthelot's investigation are not correct.

Contribution to our Knowledge on the Chlorine Derivatives of Aceton.—C. Bischoff.—A brief review of the investigation made by L. Glutz and E. Fischer on chlor- and cyan-acetons, and is here published because the author, who has been and is still engaged with researches on this same subject, desires to acknowledge the politeness of Professor Kolbe, who called his attention to the preliminary notices of the researches of the above-named authors published some time ago.

Observations on Monochloraceton.—L. Henry.—In the introduction to this essay reference is made to the researches of Friedel, Da Silva, Reboul, and the former investigation made by the author on this and collateral subjects. Next, the author states that he has obtained, synthetically, acetonic acids (*acetonsauren*)—

$$C_nH_{2n+1}-\text{-}-CO-\text{-}-COOH,$$

and more particularly pyrouvic acid, $CH_3-\text{-}-CO-\text{-}-COOH$, by the action of organic zinc compounds, $(C_nH_{2n+1})_2Zn$, upon the ethyl-oxy-oxallyl-chloride. It is further said that it has been tried to obtain this body by another process, viz., the oxidation of the corresponding alcohol, $CH_3-\text{-}-CO-\text{-}-CH_2OH$. This alcohol, hitherto unisolated, is only known as chloride- and bromide-compound, more commonly called monochloraceton and monobromaceton; the former has been submitted to the action of an alcoholic solution of acetate of potassa, by which, while KCl is formed, the acetate of the ethyl of pyrouvic acid is obtained. This substance—

$$CH_3-\text{-}-CO-\text{-}-CH_2(C_2H_3O_2),$$

is a pleasantly-smelling fluid, bitter taste, and colourless; sp. gr. at 11°=1·053; soluble in water, alcohol, and ether; vapour density=4·0. From this ether the alcohol has not as yet been obtained in free state. The author and Dr. L. Bisschopinck are engaged in researches on the products of decomposition of this ether when acted upon by different reagents.

On Sulpho-Benzophenon, and on a Product obtained by the Distillation of Benzoate of Baryta.—A. Behr.—By the action of alcoholic HKS upon the chloride of benzophenon there is formed sulpho-benzophenon, which, in pure state, is a snow-white crystalline substance, fusing at from 152° to 153°; formula, $C_{13}H_{10}S$. Although this body is readily acted upon by oxidising agents, it is not, strictly speaking, oxidised, the only result being the elimination of sulphur and the formation of benzophenon; while, when the sulpho-benzophenon is submitted to dry distillation, there is formed a fœtid-smelling oil, in small quantity, and tetraphenyl-ethylen. By the dry distillation of benzoate of baryta, the author obtained a hydrocarbon, $C_{25}H_{20}$, which appears to be identical with the hydrocarbon discovered by Kekulé and Franchimont (see Chemical News, vol. xxvi., p. 276). The bromine compounds of this body differ slightly in respect of their fusion-point and the quantity of bromine they contain, and the formation of this compound during the process of the dry distillation of the baryta salt is explained by the author as probably due to the simultaneous meeting of benzol and of benzophenon in nascent state.

Carbonated and Sulpho-Carbonated Derivatives of Isobutyl-Alcohol.—E. Mylius.—This paper contains the description of the following compounds:—Isobutyl-chlorocarbonic acid ether—

$$\begin{matrix} C_4H_9O \\ Cl \end{matrix}\!\!>\!\!CO,$$

a rather unstable fluid, decomposed at its boiling-point, and by water even at the ordinary temperature. Isobutyl-urethan—

$$\begin{matrix} C_4H_9O \\ NH_2 \end{matrix}\!\!>\!\!CO,$$

boils at from 206° to 207°; fuses at 55°. Phenyl-butyl-urethan—

$$\left.\begin{matrix} C_4H_9O \\ C_6H_5 \\ H \end{matrix}\right\}N\Big\}CO,$$

a solid crystalline body, fusing at 80°; boiling-point, 216°; difficultly soluble in water, but readily so in alcohol and ether. Toluyl-carbaminic acid butyl-ether—

$$\left.\begin{matrix} C_4H_9O \\ C_7H_7 \\ H \end{matrix}\right\}N\Big\}CO,$$

an oily fluid; boiling-point, from 275° to 280°; not solidified at −10°. Butyl-xanthonate of potassium—

$$\begin{matrix} C_4H_9O \\ KaS \end{matrix}\!\!>\!\!CS_2,$$

a yellow-coloured crystalline salt, soluble in alcohol; by dry distillation it yields oxide of carbon, butyl-sulphide, and sulphuret of potassium. Butyl-xanthonate of sodium—

$$\begin{matrix} C_4H_9O \\ NaS \end{matrix}\!\!>\!\!CS,$$

Butyl-xanthonate of ethylic ether—

$$\begin{matrix} C_4H_9O \\ C_2H_5S \end{matrix}\!\!>\!\!CS,$$

boils at from 227° to 228°; sp. gr. at 17°=1·003. Butyl-xanthonate of butyl-ether—

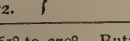
$$\begin{matrix} C_4H_9O \\ C_4H_9S \end{matrix}\!\!>\!\!CS;$$

boiling-point, 247° to 250°; sp. gr. at 12°=1·009. Butyl-xanthonate of amyl-ether—

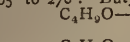
$$\begin{matrix} C_4H_9N \\ C_5H_{11}S \end{matrix}\!\!>\!\!CS;$$

boiling-point, 265° to 270°. Butyl-dioxysulpho-carbonate—

Semi-sulphuretted butyl-urethan—



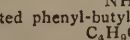
Semi-sulphuretted phenyl-butyl-urethan—



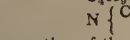
The mode of preparation of these substances is minutely described.

Contribution to our Knowledge on Butyl-Sulphydrate.—E. Mylius.—While the author's researches confirm those of Humann (*Ann. Chem. Pharm.*, vol. xcv., p. 256) on the action of nitric acid upon isobutyl-mercaptan, the main product of the action of nitric acid at 1·30 sp. gr. upon the mercaptan just mentioned is the formation of isobutyl-sulpho acid—

the salts of this acid are very soluble in water. The silver salt—



is a crystalline body; the barium salt—



is very soluble and crystalline; the lead-salt cannot be obtained in pure state, since basic salts are formed of an indefinite composition.

Action of Phosphorus upon Alkaline Metallic Solutions.—A. Oppenheim.—Reserved for full translation.

Polytechnisches Journal von Dr. E. M. Dingler, first number for November, 1872.

This number contains the following original papers and memoirs relating to chemistry and collateral subjects:—

Researches on the Gold Assay as Practised at Mint-Works.—Dr. H. Rösler.—This essay, elucidated by several tables exhibiting the results of experiments, treats at length on the ordinary gold assay (by the dry way). The general result of the author's researches is that, *ceteris paribus*, gold of lower purity (more alloyed), which has to be treated with much lead, will yield on cupellation a worse result than a purer alloy when treated precisely in the same way; and further, that when, by the fine-gold test (*feingold probe*), the loss of gold is compensated for by the quantity of silver retained, the loss of gold, when more base alloys are assayed, exceeds the quantity of silver retained—in other words, that the results of cupellation in the latter case always indicate too low a quantity of gold.

The Future of the Gold-Plating Industry.—Dr. C. Winkler.—This essay treats on the present state of this industry in Germany, and on the improvements still to be made in the manufacture of imitation jewellery.

Industrial Method of Withdrawing the Fusel Oil from Crude Spirits by means of Charcoal.—Dr. W. Schultze.—This lengthy paper enters into minute details on the following matters:—Preparation of the charcoal; the size of the lumps of the charcoal and the process of operating; on the influence of the air in the pores of the charcoal; the influence of the porosity of the coal; defuselisation and the degree of dilution of the spirit; defuselisation and the duration of contact between charcoal and spirits.

The Methods of Petroleum Collection (viz., from the Soil by Borings, &c.) in Use in America and Galicia.—A. Fauck.

Filters Made from Spun and Felted Glass.—P. Weiskopf.—At the request of the Austro-Hungarian government, the author has made a series of experiments to ascertain whether finely-spun glass-thread can be felted and made into a suitable shape for the purpose of filtering. The author has used pure hard Bohemian glass for this purpose, and finds it to answer exceedingly well and to filter rapidly, as well as yielding a perfectly clear filtrate. The author will send glass wool, as he terms it, from his residence at Morchenstern, in Bohemia, to those who feel interested in this matter.

Second number for November, 1872.

This number contains the following original matter relating to chemistry and collateral subjects:—

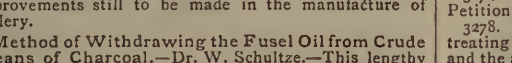
Calcining Furnaces Invented by Hasenclever and Helbig for the Purpose of Desulphurising Ores so that the Sulphur may be used for Sulphuric Acid Preparation.—R. Hasenclever.—This memoir, illustrated by engravings, contains the detailed description of a furnace so constructed that the metallic ores which contain more or less sulphur can be so calcined that the sulphur may be readily utilised for the preparation of sulphuric acid.

Theory of the Nucleus Formation (Kernbildung) during the Roasting of Cupreous Pyrites.—A. Schertel.

Essay Containing an Enumeration of the German and Best Known Foreign Clays (for Ceramic Purposes) According to their Geological Occurrence in the Tertiary and Older Formations.—Dr. C. Bischof.—This essay contains a review of the various and best known clays used for ceramic purposes.

Softening of Water by the Aid of Lime-water.—J. Stingl.—This monograph, elucidated by a series of results of analyses of water, treats on the precipitation of a large proportion of the dissolved earthy matters contained in natural waters by the aid of lime-water, which has, however, to be used only in comparatively small quantity, to be regulated by the composition of the solid matter dissolved in the water.

Preparation of Fuchsine without Arsenic Acid.—Dr. Dingler.—It appears that at the extensive aniline pigment factory of Messrs. Meister, Lucius, and Brüning at Höchst-on-the-Main, the aniline oil is converted into rosaniline by the aid of nitro-benzol. This process, which yields excellent results, may be elucidated by the following formulæ:—



Toluidine. Rosaniline. 4× Water.

Analysis of Raw Sugar, and on the Means by which more Concordant Results may be Obtained by Different Analysts.—Dr. C. Kohlrausch.—Illustrated with woodcuts.

Neues Jahrbuch für Pharmacie, von Dr. F. Vorwerk, October, 1872.

In addition to several papers strictly relating to pharmaceutical science, this number contains the following papers and memoirs bearing upon chemistry:—

Chemical Investigation of the Fruit of the Barberry (Berberis Vulgaris).—Dr. Graeger.—Leaving the stalks, the berries consist, in 100 parts, of—Husks and seeds, 15·58; soluble matter, 17·20; water, 67·22. Chemical composition of the fruit, in 100 parts:—Husks and seed, 15·58; free malic acid, 5·92; grape sugar, 4·67; gum, 6·61; ash of juice, 0·06; water, 67·16; total, 100. Ash of the husks and seeds, 2·20 per cent.

On Hyoscyamine.—Dr. G. Merck.—After observing that this alkaloid is mostly described as a crystalline solid, the author states that more recent research has proved the hyoscyamine only to be obtainable as an amorphous mass, but he adds that if this is gently submitted to distillation with hot water, there is obtained a colourless oily fluid, similar to coniine. This modification of hyoscyamine is readily soluble in alcohol, ether, and water, but only partly soluble in benzin and chloroform. By exposure to air, the fluid hyoscyamine (which exhibits a strong alkaline reaction and neutralises acids completely) becomes dark coloured, thickish, and emits an unpleasant smell. In that condition the hyoscyamine is not more soluble in ether. The oxalate of this base was obtained in crystalline form.

PATENTS.

Communicated by Messrs. Vaughan and Son, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3272. J. R. Williams, Manchester, "Improvements in cements."—Petition recorded November 4, 1872.

3278. W. Glazier, Rochdale, Lancashire, "Improvements in treating and utilising certain refuse animal and vegetable substances, and the application of the resulting substances or matters to various manufactures.—Petition recorded November 5, 1872.

3288. H. Harrison, Killenaule, Tipperary, Ireland, "Improvements in the manufacture of artificial or prepared fuel from anthracite dust or 'culm,' or from other coal dust, and in apparatus employed in such manufacture."—Petition recorded November 6, 1872.

3330. A. C. Pelly, Finch Lane, London, "Improvements in the manufacture of peat fuel, and in the machinery and apparatus therefor."—A communication from L. Von Horn, Stockholm.—Petition recorded November 9, 1872.

3460. A. Morgan, South Lambeth Road, Surrey, "An improved method for purifying and amalgamating gum resins, including Kauri gum."—Petition recorded November 20, 1872.

3497. T. H. Cotton, Huddersfield, "A new or improved fuel to be used as a substitute for and to economise coal, and the means of applying the same to feed steam-boiler and other furnaces where steam can be obtained."

3501. J. H. Player, Birmingham, "Improvements in utilising waste products obtained in the manufacture of phosphorus, and in the manufacture of certain metallic compounds containing phosphorus."—Petitions recorded November 22, 1872.

3525. J. Mitchell, Millbank Street, Westminster, "A new or improved cretaceous hydrocarbon fuel."

3529. D. Curror, Wester Craigduckie, Fifeshire, and J. Dewar, Gilmore Place, Edinburgh, "Improvements in the filtration and purification of fluids, and in the manufacture of manure."—Petitions recorded November 25, 1872.

3588. A. V. Newton, Chancery Lane, Middlesex, "Improvements in the manufacture of sugar, and in apparatus to be used therefor."—A communication from S. Dod, Havana, Cuba.—Petition recorded November 28, 1872.

NOTICES TO PROCEED.

2265. A. M. Clark, Chancery Lane, Middlesex, "Improvements in the manufacture of phosphoric acid and acid phosphate of lime, and the applications of the same."—A communication from L. H. Blanchard, Paris.—Petition recorded July 29, 1872.

2331. C. M. T. du Motay, Boulevard de Strasbourg, Paris, "An improved mechanical and chemical method of epurating the cast-irons, in order to allow the same to be directly or indirectly transformed into iron or steel."—Petition recorded August 5, 1872.

2610. J. Noad, Hackney Wick, Middlesex, "Improvements in the

manufacture of paper-pulp from wood, and in apparatus therefor."—Petition recorded September 2, 1872.

3382. E. A. Cowper, Great George Street, Westminster, "Improvements in separating the fibres of materials producing paper-pulp, and apparatus therefor."—Petition recorded November 13, 1872.

PATENTS SEALED.

1421. J. Robey, Manchester, "A new or improved filtering medium, suitable also as a disinfectant and deodoriser."—Dated May 10, 1872.

1722. T. Gray, New Wandsworth, Surrey, "Improvements in the means of treating vegetable fibres for the manufacture of paper."

1723. J. J. Harrop, Manchester, and W. Corbett, Bradford, Lancashire, "Improvements in puddling iron and in puddling furnaces."—Dated June 7, 1872.

1742. C. A. Faure, Brook Street, Lambeth, "Improvements in the process or processes of applying electric currents to chemical decompositions and combinations, including the manufacture of alkalies."—Dated June 10, 1872.

1885. J. Horsley, Chéltenham, "An improvement in the manufacture of an explosive compound and a new mode of firing explosive compounds."—Dated June 22, 1872.

1905. W. E. Newton, Chancery Lane, Middlesex, "Improvements in the manufacture of vinegar, and in the acidulation or treatment of various liquids, and in the apparatus employed therein."—A communication from R. D. Turner and J. Vanderpool, New York, U.S.A.—Dated June 24, 1872.

2046. E. P. H. Vaughan, F.C.S., Chancery Lane, Middlesex, "Improvements in the mode of utilising the waste gases of metallurgical and other furnaces."—A communication from F. Pernot, Paris.—Dated July 6, 1872.

2920. J. Saunders and J. Piper, Cookley Iron Works, near Kidderminster, "Improvements in coating tin and terne plates, and in apparatus employed therein."—Dated October 3, 1872.

MEETINGS FOR THE WEEK.

Monday, Dec. 23rd.—Medical, 8.
—— Society of Arts, 8. Cantor Lectures. Dr. C. Meymott Tidy.
Friday, 27th.—Quekett Club, 8.
Saturday, 28th.—Royal Institution. Professor Odling, M.A., F.R.S., "On Air and Water."

THE
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IV. A Solution of the Sewage Problem.
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VI. Remarks upon the Present State of the Devonian Question. By Horace B. Woodward, F.G.S.

Notices of Books. Progress of the Various Sciences, &c., &c.

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THE CHEMICAL NEWS.

Vol. XXVI. No. 683.

COLOURING-MATTERS DERIVED FROM AROMATIC AZODIAMINES.*

By A. W. HOFMANN, Ph.D., F.R.S., and A. GEYGER, Ph.D.

II. Safranine.

Whilst we were engaged with the study of the blue colouring-matters produced by the action of aromatic monamines on azodiphenyldiamine, our attention became directed to a beautiful red tar-pigment, which has been known for some time by the commercial name of safranine, being extensively used as a substitute for safflower in dyeing silk and cotton. Safranine has not as yet been minutely examined; but, as far as can be judged from the scanty information we possess regarding its production, it is scarcely doubtful that this important dye must be looked upon as being the derivative of an azodiamine. The analyses of safranine thus promised to throw considerable light upon the nature of the compounds under examination.

The starting-point of our studies was the dye such as it occurs in commerce. The greater portion of it was supplied to us by Messrs. Tillmanns, in Cryfeld. Another specimen was received from Dr. T. Wolf, and for a third we are indebted to our friend M. Charles Girard, in Paris. Both the first-mentioned specimens were assigned to us as produced on the large scale; the last was prepared by M. Girard himself.

Safronine occurs in commerce either as a solid body or *en pate*. In the solid state it forms a yellowish-red powder, in which, together with considerable quantities of chalk and common salt, the chlorhydrate of a tinctorial base has been recognised. The pure dye may be easily separated from the crude safranine. It is only necessary to exhaust the commercial product with boiling water; on cooling, the filtrate deposits a slightly crystalline substance, which, after several re-crystallisations from boiling water, leaves no residue on ignition. During these operations, however, the salt undergoes perceptible alteration; with every re-crystallisation it becomes more soluble and less crystalline. These alterations depend upon the separation of chlorhydric acid from the salt. In fact the percentage of chlorine is found to diminish in the product of successive crystallisations; thus the product of the third contained 8·48 per cent, that of the fourth crystallisation only 7·46 per cent. Addition of chlorhydric acid to the mother-liquors at once reproduces a crystalline precipitate. This instability of the chlorhydrate, and in fact, as may even now be stated, of the salts of safranine in general, has very considerably impeded the study of this body, and often materially affected the accuracy of the analytical results. In order to obtain the normal salt, the boiling liquid during the last crystallisation had always to be acidified with chlorhydric acid.

Safranine chlorhydrate separates in fine reddish crystals from the acid solution on cooling; an appreciable quantity of the compound, however, remains in solution. The salt dissolves both in water and alcohol more readily when hot than when cold; it is insoluble in ether, as also in concentrated saline solutions. The alcoholic solution, like the aqueous, is of a deep red-yellow colour; it exhibits a peculiar fluorescence, which in a measure recalls that of Magdala-red. Ether precipitates the salt from the alcoholic solution. Numerous analyses which we have made of this salt lead to the following two formulæ:—

$$C_{20}H_{21}N_4Cl \quad \text{and} \quad C_{21}H_{21}N_4Cl,$$

the theoretical values of which agree almost equally well with the averages of the experimental numbers. We were doubtful at first to which of these two formulæ preference should be given. Indeed the assumption of twenty atoms of carbon in the molecule of safranine had its seductions; however, the values of the second formula agreed perhaps somewhat better with the results of analyses. Indeed we found invariably somewhat less nitrogen than the quantity required by the former formula, whilst it is well known that the volumetric method invariably gives an excess; so that we should have adopted the second formula, even if later experiments on the preparation of safranine had not altogether excluded the former one.

Platinum Salt of Safranine.—The numbers obtained in the analysis of the chlorhydrate are confirmed by the investigation of the platinum salt. This compound is obtained by precipitating a solution of the chlorhydrate by excess of platinum perchloride; dilute hydrochloric acid must be used to wash this precipitate, as pure water appears to decompose it. The platinum salt forms a yellowish-red crystalline powder, nearly insoluble in water, alcohol, and ether.

If the salt suspended in boiling water be treated with sulphhydric acid, sulphide of platinum is slowly formed, whilst unaltered chlorhyhrate of safranine remain in solution. The analysis of the salt, dried at 100°, gives numbers corresponding to the formula—

$$2(C_{21}H_{20}N_4HCl)PtCl_4.$$

Free Base.—In order to prepare some other salts of safranine it was necessary to obtain the free base. When we first commenced the study of this new compound, remembering the properties of the tinctorial ammonias in general, we endeavoured to precipitate the base from the chlorhydrate by alkalies. Ammonia, however, is without any action whatever over salts of safranine; and only in the most concentrated solutions does soda produce a precipitate, which immediately re-dissolves on addition of water. This precipitate is obviously nothing but chlorhydrate rendered insoluble by the sodium chloride formed, or by the concentrated soda solution. Free safranine being soluble in water, there remained no other process for liberating the base than treatment of the chlorhydrate with silver oxide. On evaporating the deep yellow-red coloured liquid obtained in this way a deposit of red-brown crystals is formed on cooling, which while moist scarcely differ from those of the chlorhydrate, but when dried at 100°, assume a greenish metallic lustre. Free safranine easily dissolves in water and alcohol, but is insoluble in ether. Addition of chlorhydric acid to the aqueous solution at once reproduces the crystalline chlorhydrate. We have not been fortunate enough to obtain free safranine in a state of perfect purity; the solution invariably retains a small quantity of silver chloride, which separates with the crystallising product; it may be recognised by burning the base, when a small incombustible residue is left. If the chlorhydrate be reproduced from the free base, so much silver chloride is mixed with the salt, that the percentage of chlorine, found on analysis, is appreciably raised. An estimation of chlorine in the chlorhydrate thus prepared gave 10·8 per cent, instead of 9·74. Free safranine, however, may be used without difficulty in the preparation of other salts, the nitrate for instance.

Safranine nitrate is easily obtained when an excess of dilute nitric acid is added to a hot aqueous solution of the free base. On cooling the salt crystallises in red-brown needles, which are very insoluble in cold but readily dissolve in boiling water. They are considerably more soluble in alcohol than in water. The nitrate is decidedly less soluble than the chlorhydrate; a solution from which the latter salt has been thrown down by

* A Paper read before the Royal Society.

chlorhydric acid still gives a precipitate with nitric acid.

The analysis of the nitrate, dried at 100°, leads to the formula $C_{21}H_{21}N_5O_3 = C_{21}H_{20}N_4.HNO_3$.

Safranine picrate.—We have finally investigated the picrate. It is obtained by simply adding an aqueous solution of picric acid to the mother-liquors of the chlorhydrate or nitrate, and washing the precipitate thus formed with water. The picrate forms red-brown needles, which are insoluble in water, alcohol, and ether.

The analysis gave results corresponding to those obtained in the investigation of the chlorhydrate of the platinum salt and of the nitrate, and leading to the formula $C_{27}H_{23}N_7O_7 = C_{21}H_{20}N_4.C_6H_3(NO_2)_3O$. We have no further analytical data to offer at present. A brief notice of several other salts we have prepared may, however, still be appended.

Safranine bromhydrate is deposited on addition of bromhydric acid to a solution of the base, as a crystalline powder, consisting of microscopic needles, which are so insoluble in water that the liquid from which they have been precipitated appears almost colourless. The salt is soluble in boiling water, from which it crystallises on cooling. It is worth mentioning that, on adding bromine water to a solution of the chlorhydrate, a red crystalline precipitate is formed, which is difficultly soluble in cold water, but may re-crystallise from boiling water. In this way needle-shaped crystals are obtained which, when pure, possess a green metallic lustre. They have not yet been analysed.

The *iodhydrate*, as regards preparation and properties, is perfectly similar to the bromhydrate.

The *sulphate of safranine* is a tolerably soluble salt: only in the most concentrated aqueous solution of the base is a precipitate produced on addition of dilute sulphuric acid; the salt dissolves on heating the liquid, and is again deposited on cooling in the form of fine needles.

The *oxalate* behaves very similarly, but is a little less soluble than the sulphate; with acetic acid the base gives no precipitate; by spontaneous evaporation the acetate separates in rather indistinct crystals.

All the salts of safranine exhibited very characteristic reaction; on adding chlorhydric acid to the solution of the salt, the red-brown colour of the liquid changes to a beautiful violet, which, on addition of more acid, becomes a deep blue, then a dark green, and finally bright green; if the acid liquid be slowly diluted with water, these changes of colour may be observed in inverse order.

It need scarcely be mentioned that in the course of this investigation our attention has been repeatedly directed towards the preparation of safranine; it may, however, at once be stated that our experiments on this subject have yielded but scanty results. As yet but little is known regarding the preparation of safranine on a large scale. According to a brief notice published by Mené*, safranine is obtained by treating aniline successively with nitrous and arsenic acids; this process very closely agrees with the method by which M. Girard, as he informs us, has prepared the specimen transmitted to us. We have, moreover, to thank M. Girard for pointing out that aniline of a very high boiling-point is especially adapted to the preparation of safranine.

After some practice we have been able, by working according to these indications, to obtain safranine with all the properties of the commercial product. The yield, however, was always very small, an exceedingly large quantity of little attractive by-products being invariably formed. Somewhat more satisfactory results were obtained when chromic instead of arsenic acid was used as oxidising agent. Our experiments, though unsuccessful as regards the discovery of a good method for preparing safranine, they nevertheless appear to supply some welcome indications as to the real source of the colouring-matter. Neither from pure aniline nor from solid toluidine have we been able to obtain safranine by the above-mentioned process; nor did a mixture of pure aniline on the solid toluidine yield a better result. We have, however, invariably obtained safranine when liquid toluidine, boiling at 198°, was used for the experiment. This colouring-matter thus appears to become a pure derivative of toluidine, and the formula $C_{21}H_{20}N_4$, to which analyses had led, is corroborated, as far, at all events, as the number of carbon atoms in the molecule of safranine are concerned, in a most satisfactory manner by the formation of this body. In this formation, as in that of rosaniline and of the allied tinctorial ammonias, 3 mols. of monamine associate to a complex molecule, 3 atoms of hydrogen in which are displaced by one of nitrogen, and 4 atoms of hydrogen being, moreover, removed by oxidation.

$$3C_7H_9N + HNO_2 = C_{21}H_{24}N_4 + 2H_2O.$$
$$C_{21}H_{24}N_4 + 2O = C_{21}H_{20}N_4 + 2H_2O.$$

A glance at the safranine formula with its four nitrogen atoms recalls the composition which Mr. Perkin ascribes to mauveine.

Safranine .. .. $C_{21}H_{20}N_4$.
Mauveine .. .. $C_{27}H_{24}N_4$.

The idea suggests itself that mauveine might be phenyl-safranine, $C_{27}H_{24}N_4 = C_{21}H_{19}(C_6H_5)N_4$. In fact safranine salts yield a violet colouring-matter when boiled for some time with aniline; again, safranine and mauveine exhibit nearly the same changes of colour under the influence of concentrated acids. Further, from a short notice published some years ago by Mr. Perkin,* safranine appears to be a by-product in the preparation of mauveine.

Relations such as suggested by the above formulæ must, however, be received with great caution. The violet colouring-matter derived from safranine has, by phenylation, not as yet been further characterised. No great stress can be laid on the similar colour reactions, with acids, exhibited by both bases; since the methylate rosaniline, on treatment with acids, also becomes first blue and then green. Moreover, it is doubtful whether the base obtained by Mr. Perkin as a secondary product in the manufacture of mauveine really is the same safranine which we have investigated, inasmuch as some preliminary analyses have led him to a very different composition, which appears to be expressed by the formula $C_{18}H_{18}N_4$. Finally, the composition of mauveine itself cannot be looked upon as established above all question; at least Mr. Perkin† seems still to hesitate between the formula $C_{26}H_{24}N_4$, which appears to result from more recent experiments, and the formula $C_{27}H_{24}N_4$, previously announced by him.

The relations here pointed out are, however, well worthy of a thorough experimental investigation, As we intend to continue this inquiry, an opportunity may present itself for their further elucidation.

* Mené, from the *Revue Hebd. Chim. Scient. Indust.*, Feb. 29, 1872, in Chemical News, vol. xxv., p. 215.

* Perkin, *Proc. R. Inst. of Great Britain*, vol. v., p. 572.
† Perkin, *loc. cit.*

INDUSTRIAL MANUFACTURE OF CHLORINE.

By F. de LALANDE and M. PRUD'HOMME.

The reaction of anhydrous sulphuric acid mixed with air or oxygen upon heated alkaline chlorides, which has given rise to Deacon's patent for the preparation of chlorine and of sulphate of soda, has led us to generalise this process. We have chiefly experimented with silicic, boric, stannic, and phosphoric acids, and also with alumina. When any of these bodies, silica, for instance, is mixed with an alkaline chloride, or with an alkaline-earthy or earthy chloride, and over this mixture, while being heated to red heat, a current of dry oxygen or air is passed, chlorine is evolved, and a silicate formed of the base of the chloride

employed, $SiO_2+ClNa+O=SiO_2NaO+Cl$. At red heat, therefore, oxygen expels chlorine, when there is simultaneously present an acid capable of uniting with the base which is formed. Chlorides heated *by themselves* in a current of oxygen (chloride of calcium, for instance) do not give off chlorine. When a current of *hydrochloric acid* gas is passed along with oxygen over the mixture of silica and chloride the acid regenerates the chloride and decomposes the silicate—

$$SiO_2NaO+HCl=SiO_2NaCl+HO.$$

In this way a *continuous* evolution of chlorine is obtained. Instead of taking the mixture of chlorine and silica, the silicate of the metal in which the chloride is contained, or a mixture of silica and the oxide of that metal is taken. Since analogous reactions occur with the acids above mentioned, we may state that it is general. The steam formed during the phase of reaction—

$$SiO_2NaO+HCl=SiO_2+NaO+ClO$$

gives rises to two secondary actions :—

(1). The chlorine decomposes the water at red heat :—

$$HO+Cl=HCl+O.$$

(2). The steam decomposes the chlorides at red heat :—

$$NaCl+HO=NaO+HCl.$$

It is probable that under these conditions an equilibrium exists between the quantities of chlorine, aqueous vapour, and hydrochloric acid issuing from the apparatus, or a limit of maximum between the quantity of chlorine produced and the hydrochloric acid evolved and issuing from the apparatus. This limit of maximum will be the greater according as the temperature required for the reaction be less high. Some of our experiments having been made by causing the substances operated with to be imbibed by pumice-stone, we have been induced to try whether pumice-stone alone would yield any result, that material being a complex silicate and a substance belonging to the category of those indicated by us. We have found that with pumice-stone an evolution of chlorine is obtained comparable to that obtained from the other substances, more particularly silica and lime, boric acid and lime, stannic acid and lime, alumina and chloride of sodium ; since the same result is obtained with lumps of brick, it might be ascribed to the porosity of these substances; but this opinion is gainsayed by the fact that under the same conditions pipe-clay, a silicate of alumina and a very porous body, does not give rise to any appreciable reaction ; it therefore appears possible that hydrochloric acid converts the surface of pumice-stone into a mixture of silica and chlorides. We have compared the production of chlorine in our experiments with that obtained by using bricks impregnated with sulphate of copper (Deacon's patent) ; the quantity of chlorine obtained in both cases is the same ; but with bricks impregnated with sulphate of copper the reaction takes place at a lower temperature. The imperfection of our apparatus has hitherto prevented us from estimating the respective quantities of chlorine, hydrochloric acid, aqueous vapour, contained in the gases issuing from the apparatus ; neither have we been able to estimate exactly the degree of temperature at which the reactions take place.

MINERALOGY.

Mr. W. W. Smyth, F.R.S., took for the subject of his fifth lecture of the course to working men, delivered on Monday, December 9th, "Carbon and Coals."

The substances of which he proposed to speak were all characterised by consisting wholly or principally of carbon, although differing very much in their outward forms. The diamond is a crystallised form of pure carbon, remarkable from the earliest times for its great brilliancy and extraordinary hardness. Its hardness is so great as to render it capable of cutting or scratching all other substances; and this character has lately been taken advantage of in a very ingenious application of the diamond to boring or drilling holes through hard rock masses. For this purpose a number of pieces of diamond—of course of the inferior qualities—are set in a ring round the end of a tube, and it is found that by this means very rapid progress can be made, compared with that accomplished by the use of steel tools alone. The simplest crystalline form assumed by the diamond is that of octahedron, very frequently with the edges a little worn and rounded ; and the more complicated crystals are all capable of being split parallel to the faces of the octahedron. This property of splitting is taken advantage of to obtain fragments with sharp edges for cutting purposes. The great brilliancy of the diamond is due entirely to the very great refractive power ; on account of which, many of the rays of light falling upon a piece of diamond are so much refracted as to be reflected from the interior, and when the diamond is cut into suitable facets, the brilliancy is so great as to have obtained for the form the name of "brilliant." The origin of the diamond is not yet cleared up. It is found in the detrital matter brought down by streams in parts of Brazil, India, and the Cape of Good Hope.

Graphite (from *grapho* to write) is a substance exactly like diamond in its chemical composition, but very different in outward appearance and its crystalline form. The latter is very distinct, being chiefly that of minute hexagonal scales, the minuteness and incoherence of which render it usually so soft, and also enable it to be employed as an anti-frictional material. Thus we have two substances formed of the same material carbon, but at opposite extremities of the scale of hardness. Varieties of it are found containing from 90 to 95 per cent of carbon ; the remainder is impurity in the shape of iron oxide, &c. It is now, especially in some parts of Central Europe, in great request for the manufacture of crucibles, in consequence of its great degree of infusibility. The purest kinds of it are not, as people used to believe, confined to Borrowdale in Cumberland ; enormous quantities are now raised and imported from Ceylon, Canada, Bavaria, Bohemia, &c.

In coals,—which taken on the large scale are far more important to us than the diamond—the carbon loses its distinct crystalline state, and is mixed more or less with other materials. The lecturer then briefly explained the manner in which the coal occurs, viz., in bands or layers, technically known as "coal-seams" of various thicknesses, alternating with other strata of indurated clay, known as shale, and of grey sand-stone, called grit. At the base of each bed of coal is found a bed of clay, which contains the fossil roots of the plants from which the coal has been formed. The beds are not in all cases horizontal, though originally deposited so, but have been tilted up into various positions. They vary, too, a great deal in thickness, being in some cases too thin to be profitably worked, *i.e.*, under present conditions. The following list gives the number of workable seams, and the average total thickness of them in several localities for purposes of comparison. South Wales, 57 seams, 179 feet thick : North Staffordshire, 62 seams, 165 feet; Derbyshire, 40 seams, 86 feet ; Newcastle, 16 seams, 50 feet ; Westphalia, 83 seams, 173 feet ; Saarbruck, 164 seams, 338 feet. It will be seen that the supply to the Newcastle field is strictly limited ; the adjoining Durham coal-field has lately been proved beneath the sea.

On examining a lump of coal, it may be frequently be observed to be made up of a series of parallel laminæ, sometimes as many as 20 to an inch. Sometimes these layers are alternately bright and dull, and are really two distinct varieties of coal, one burning with far more flame and smoke than the other. These laminæ are, or have been, more or less horizontal, but in some districts there is also a set of parallel divisional planes running in a direction at right angles to the first set of laminæ. These are of great value and importance to the miner in getting the coal, for

by taking advantage of these planes he can obtain a larger proportion of large coal than if he has to break down irregular lumps with his pick. Occasionally, a third set of parallel lines occurs at right angles to the last set, and then the coal breaks into more or less cuboidal or rhomboidal blocks with smooth faces.

If we classify coals according to their proportions of carbon, which is the heat-giving element, and therefore the measure of their quality as fuel, we have first anthracite or stone coal, with 90 to 98 per cent of carbon, worked amongst other places in the west part of the South Wales coal field. It is rather difficult to light, but makes extremely hot fires when fairly set going. Next come the steam, smokeless, or free burning coals, worked round Merthyr-Tydvil and Aberdare, which are highly valued for steamers, and especially for men-of-war. Then comes a great series of coals such as are found in the Midland Counties, and supplied to most parts for household purposes. These are more or less bituminous, burning with a greater quantity of flame and smoke than either of the two preceding varieties. Cannel coal does not soil the fingers, and is capable of taking a fair polish. It is worked in large quantities about Wigan in Lancashire. Lignite, or brown coal, is an intermediate state between true wood and true coal, having frequently a texture and appearance much like wood. It contains less carbon and more gaseous matters than true coal, and gives off a great deal of smoke. It occurs in Saxony, and Bohemia, &c., on the Continent; and on a small scale in England, at Bovey Tracey.

Errata.—P. 297, col. 2, line 9 from bottom, for *bars* read *arches*. P. 298, col. 2, line 36 from top, for *Aduli* read *Adula*. Line 38, for $\dddot{A}l\,\dddot{S}i_3 + K\,\dot{S}i$ read $\dddot{A}l\,\dot{S}i_3 + K\,\dot{S}i_3$. Line 15 from bottom, for Ca_3Si read Ca_3Si_2. Line 5 from bottom, for *streets* read *villages*. P. 299, line 19 from top, for $12\dddot{A}l\,\dddot{S}i + (2AlF_3 + 3SiF_2)$ read $6\dddot{A}l\,\dddot{S}i + (AlF_3 + SiF_2)$. Line 28, for $\dddot{A}l\,\dddot{S}i + Be\,Si$ read $\dddot{A}l\,\ddot{S}i_3 + \ddot{B}e\,\ddot{S}i_3$.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 19th, 1872.

Prof. Williamson, F.R.S., Vice-President, in the Chair.

After the minutes of the previous meeting had been read, Messrs. E. M. Prevost, Ph.D. and F. H. Hobler were formally admitted Fellows of the Society.

A list of the Donations made to the Society then followed, and the names of Messrs. Charles Lees, John Abigal Bower, Miles H. Smith, George Frederick Schacht, Alfred J. Cownley, and Walter E. Koch were read for the first time; for the third time, Messrs. Alfred Payne, George Combe Stewart, Robert Routledge, D.Sc., and George B. Beilby, who were then balloted for and duly elected.

The first paper entitled "*Analysis of Water of the River Mahanuddy*," by E. Nicholson, was read by the Secretary. The author first details the method he pursued in order to clarify waters which remain turbid even after standing for a long time, and also for determining the amount of suspended silt. This he effects by the addition of ammonium sulphate to the water, and subsequent concentration whereby the silt separates in flocks which are capable of being collected on the filter. He then proceeds to describe the position of the Mahanuddy river, its course, and the geological structure of its bed, &c.; and gives the results of his analyses of the water, from which he finds that it contains less dissolved matter than any other river in India; the total amount of mineral solids being 0·12 grm. per litre, of which 0·0343 grm. was suspended silt. The hardness of the water by the soap-test was 5° of the centigrade scale.

Dr. Williamson said that, from the author's experiments, this water appeared to offer some points of difference from ordinary waters, especially the difficulty of separating the suspended matter. With regard to the process he adopts of treatment with ammonic sulphate, it was a question how far it might alter the composition of the constituents of the water.

Mr. Warington remarked that in the case of flood-water passing over a clayey soil, and which was very difficult to clear, it had been found that all salts, and especially calcium salts, caused a coagulation of the suspended matter, which greatly facilitated the subsidence of the silt and filtration of the water.

Mr. Thorpe said that he could corroborate Mr. Warington's remarks. He had recently examined a turbid water which passed, apparently unaltered, through four thicknesses of Swedish filter-paper, but after treatment with sulphurous anhydride it became capable of being filtered. The difficulty in introducing such substances as precipitants was, that they are liable to take down other constituents of the water besides the suspended matter. He had found loam to be preferable to sand for filtering water.

In reply to a question of Dr. Warren de la Rue, Mr. Thorpe further stated that he had frequently examined silts from flood-waters microscopically, but had never been able to detect any traces of organic life.

The Chairman observed that the use of sulphate of alumina to assist the clarification of waters in which the organic constituents were to be determined, as practised by the author, was highly improper; it was almost certain that a change would be produced. The same might be said of the effect of calcium chloride in waters containing acid silicates, some of the silica must be taken down. For his own part, he thought the most satisfactory plan was to allow the water time to settle.

The second paper "*Researches on the Polymerides of Morphine and their Derivatives*," by E. Ludwig Mayer and C. R. A. Wright, D.Sc., was read by Dr. Wright, and illustrated with specimens of many of the substances mentioned. The memoir consisted of several papers, the first being on the action of zinc chloride on morphine. At low temperatures, and with concentrated solutions of the zinc salt, tetrapo-dimorphine (apo-morphine) appears to be the principal product, but at higher temperatures and with the addition of strong hydrochloric acid a "tetra" polymeride of apo-morphine is formed, which may be called octapo-tetramorphine. The principal results enumerated in the second paper, "On the Action of Hydrochloric Acid on Morphine," are that besides apo-morphine mixtures of three bases are produced which may be written $M + 3HCl$, $M + 3HCl - H_2O$ and $M_4HCl - 2H_2O$, where M stands for morphine, $C_{34}H_{38}N_2O_6$. The action of sulphuric on morphine appears generally to yield polymerides without abstraction of water, the principal products being the sulphates of trimorphine, $C_{102}H_{114}N_6O_{18}$, and tetra-morphine, $C_{136}H_{152}N_8O_{24}$. The authors also describe the results of the action of hydrochloric acid on trimorphine and tetra-morphine and state the physiological action of the various bases, concluding with a table of the names, formulæ, &c., of no less than nineteen derivatives of morphia.

The Chairman in thanking the authors for laying before them the results of their elaborate researches, alluded to the wide field which they embraced, offering various interesting points for discussion.

Mr. Prosjean remarked that the subject was certainly a large one, and already sufficiently bewildering, so that he must protest against the use of some of the names which the authors had employed, more especially the introduction of prepositions into them. Some of the old names were certainly unwieldly enough, but he preferred them to such terms as apomorphine, in which there was nothing

to signify that it was derived from morphia by the abstraction of water. It might equally mean that anything else was taken away.

Dr. WRIGHT replied that the title was first employed by the late Dr. Matthiessen to signify that the substance was a derivative from morphia, and that it had now become a conventional term to signify the abstraction of water, and was certainly less a misnomer than such names as oxygen.

Mr. VERNON HARCOURT certainly thought that there was no reason for the introduction of prepositions into chemical names without any consideration of the fitness of the term. The prefix "apo" certainly gave no indication that the substance was a derivative formed by the abstraction of water.

Dr. H. E. ARMSTRONG then brought forward "Communications from the Laboratory of the London Institution, Nos. VIII.—X." In the first of these, entitled "*Derivatives of β-dinitrophenol*," he describes the monoiodo-, chloro-, and bromo-derivatives of β-dinitrophenol, a compound produced, along with α-dinitrophenol, when the volatile modification of mononitrophenol is acted upon by nitric acid. The new compounds were prepared by the direct action of the corresponding halogen on the β-dinitrophenol. Iodo-β-dinitrophenol, obtained by the action of iodine and mercuric oxide on β-dinitrophenol, crystallises in bright yellow needles, which melt at 113°. The potassium derivative forms brilliant red flat needles, which exhibit a marked dichroism, the reflected light being metallic green in one direction, yellow in another. The corresponding bromo-β-dinitrophenol melts at 116°, and yields a yellowish brown potassium derivative.

In the second communication, "*Note on the Action of Bromine in presence of Iodine on Trinitrophenol (Picric Acid)*," the author first alludes to Dr. Stenhouse's experiments on the action of bromine on picric acid, and to his later experiments on the action of chlorine on picric acid in the presence of iodine, which yielded a chloro-dinitrophenol, and then states that he had also succeeded in isolating the first product of the action of bromine on picric acid, viz., bromo-dinitrophenol. The chloro-dinitrophenol obtained by Stenhouse is isomeric with the body formed by chlorinating α-dinitrophenol; hence it might have been expected that the corresponding bromo-derivatives would also be isomeric. The author finds that there is a very close resemblance between the bodies from the two sources, even if they be not actually identical; this, however, cannot be satisfactorily settled until the product from trinitrophenol has been obtained in a pure state.

A "*Preliminary Notice on Iodo-Nitrophenols*" then followed. The author has commenced the examination of these bodies in order to ascertain whether any definite relation exists between the melting-points of the iodo-, bromo-, and chloro-nitrophenols. In order to prepare these compounds, the nitrophenols, in alcoholic solution, were acted on by iodine and mercuric oxide. The iodo-dinitrophenol, from α-dinitrophenol, was found to melt at 105°, Körner giving 114° as its melting-point. The action of iodine on ortho-nitrophenol was found to give rise to the formation of diiodo-nitrophenol, melting at 155·5°, even when the quantity of iodine employed was only sufficient to form the monoiodo-derivative, nitrophenol remaining unacted on, a result similar to that obtained when acting on an alcoholic solution of phenol-parasulphonic acid by iodine and mercuric oxide, a diiodo-phenol-sulphonic acid being formed. In like manner, chlorine and bromine, when acting upon the same acid, give rise to the formation of di-substitution products. The author has also prepared the mono- and diiodo-derivatives of the volatile modification of nitrophenol.

The CHAIRMAN thanked the author, in the name of the Fellows, for his interesting communication and for the series of beautiful specimens with which he had illustrated it.

In reply to a question put by Dr. Wright, as to the iodine substitution-compound having a lower melting-point than the chlorinated derivative, whilst the brominated one was higher, Dr. ARMSTRONG remarked that the relation of the fusing-points depended entirely on the series to which the substance belonged, and instanced several cases in which different relations subsisted between various haloid derivatives.

The last paper, a preliminary notice "*On the Formation of Naphthaquinone by the Direct Oxidation of Napthalene*," by CHARLES E. GROVES, was read by the author, in which, after drawing attention to the fact that naphthaquinone itself had not yet been carefully examined, he described the method of preparing it by the action of chromic anhydride on naphthaline in solution in glacial acetic acid. The naphthaquinone is a crystalline body of a fine yellow colour, which, when boiled with strong hydriodic acid and phosphorus, takes up a molecule of hydrogen and becomes converted into hydro-naphthaquinone, a colourless substance crystallising in needles. When equal molecular weights of the quinone and the hydroquinone are boiled together in aqueous solution, an intermediate quinone, of a dark purple colour, is formed, corresponding to the green hydroquinone of the benzol series. The same substance is produced by the action of weak hydriodic acid on naphthaquinone.

Dr. ARMSTRONG remarked that it would be very interesting to try the action of chromic anhydride in a similar manner on the chlorinated derivatives of naphthalene, in order to ascertain whether they would yield quinones or split up with formation of phthalic acid.

The CHAIRMAN, after returning thanks to the author for his interesting communication, stated that the next meeting would take place on Thursday, January 16th, when papers would be read "On Several Vanadates of Thallium," by T. Carnelly; "On Heptanes from Petroleum," by C. Schorlemmer; and "On Ethylamyl," by Mr. Grimshaw.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, November 26th, 1872.

J.P. JOULE, D.C.L., LL.D., F.R.S., &c., President, in the Chair.

Dr. R. ANGUS SMITH, F.R.S., said that he, like others, had observed that the particles of stone most liable to be in long contact with rain from town atmospheres, in England at least, were most subject to decay. Believing the acid to be the cause, he supposed that the endurance of a siliceous stone might be somewhat measured by measuring its resistance to acids. He proposed, therefore, to use stronger solutions, and thus to approach to the action of long periods of time. He tried a few specimens in this way, and with most promising results. Pieces of about an inch cube were broken by the fall of a hammer, and the number of blows counted. Similar pieces were steeped in weak acid; both sulphuric and muriatic acids were tried, and the latter preferred. The number of blows now necessary was counted. Some sandstones gave way at once and crumbled into sand; some resisted long. Some very dense siliceous stone was little affected; it had stood on a bridge unaltered for centuries, in a country place, however. These trials were mere beginnings; he arranged for a very extensive set of experiments to be made, so as to fix on a standard of comparison, but has not found time.

"*On some Points in the Chemistry of Acid Manufacture*," by H. A. SMITH, F.C.S.

The author endeavours to throw some light on th interior economy of the lead chamber as at present used in the manufacture of sulphuric acid, by making first:—

An Experimental Examination of the Causes which Determine the Action, inter se, of the Gases in the Lead

Chamber.—The conclusion come to differed from that generally received. He believes that action can take place between dry sulphurous acid and nitric acid gases, without the use of steam, and showed by several experiments that, if action be commenced between the above-mentioned gases, it continues, even in the absence of air, till all the available oxygen present in the nitric acid has been made use of.

He also comes to the following conclusions:—

1. That the volume of steam introduced should be less than the combined volumes of the two gases.
2. That the volume of steam introduced should increase in proportion to the increase of temperature.
3. That the greatest amount of action between the two gases (and therefore the greatest yield of vitriol) takes place near the surface of previously-formed sulphuric acid, and that therefore in "starting" the working of a chamber sulphuric acid should be run upon the bottom in preference to water, as at present generally done.
4. That the upper part of the chamber is of use principally as a "reservoir," and that little or no action takes place between the gases at that part.

The next point claiming attention was:—

The Distribution of the Gases in the Lead Chamber.—The following tables will show the results arrived at:—

SULPHUROUS ACID.—TABLE I.

Length of Chamber in feet.	10	20	30	40	50	60	70	80	90	100	110	120	130	140	Length of Chamber in feet.
No. 2. ft. in height, 15 (Entrance.)	72%	70 to 72%	46%	31 to 33%	25%	26%	30%	22%	29 to 30%	22%	23%	13%	18%	18%	15 feet in height. (Exit.)
No. 1. ft. in height, 3 (Entrance.)	3%	8%	16%	29%	28%	18%	19%	20%	17%	17%	14%	13%	8%	16%	3 ft. in height. (Exit.)
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	

Length of Chamber in feet.

No. 1 represents the percentage of acid at 3 feet from bottom of chamber.
No. 2 „ „ 15 „ „

SULPHURIC ACID.—TABLE II.

Length of Chamber in feet.	10	20	30	40	50	60	70	80	90	100	110	120	130	140	Length of Chamber in feet.
No. 2. ft. in height, 15 (Entrance.)	0%	0%	6%	18%	23%	20%	18%	16%	19%	12%	12%	7%	7%	10%	15 ft. in height. (Exit.)
No. 1. ft. in height, 3 (Entrance.)	81%	89%	76%	70%	68%	67%	60%	56%	48%	30%	38%	30%	36%	33%	3 ft. in height. (Exit.)
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	

Length of Chamber in feet.

No. 1 represents the percentage of acid at 3 feet from bottom of chamber.
No. 2 „ „ 15 „ „

NITRIC ACID.—TABLE III.

Length of Chamber in feet.	10	20	30	40	50	60	70	80	90	100	110	120	130	140	Length of Chamber in feet.
No. 2. ft. in height, 15 (Entrance.)	25%	18%	13%	13%	8%	7%	14%	13 to 14%	16%	20%	7%	3%	6%	6%	15 ft. in height. (Exit.)
No. 1. ft. in height, 3 (Entrance.)	8%	3%	6%	4%	4%	12%	8%	17%	20%	26%	26%	15%	12%	3%	3 ft. in height. (Exit.)
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	

Length of Chamber in feet.

No. 1 represents the percentage of acid at 3 feet from bottom of chamber.
No. 2 „ „ 15 „ „

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section).

Ordinary Meeting, December 9th, 1872.

Dr. Wallace, F.R.S.E., President, in the Chair.

"*The Volcanic Vapours of Mount Vesuvius.*" A paper by Mr. James Anderson was read on this subject, giving an account of a visit to Vesuvius in the month of October, 1871. On approaching the mountain, thin white clouds were observed to issue from its side and top; they were persistent, and continued to float for a long time against the dark blue sky as far as the eye could follow them. It was, therefore, naturally inferred that these clouds were not steam or the vapour of water, otherwise they would have been dissolved in the dry, hot air which surrounded them in the same manner as the vapour issuing from the funnel of a locomotive.

Having accomplished about three-fourths of the ascent, the party arrived at the foot of the small cone which emitted one of the continuous clouds of vapour. From its crater the latest flow of lava was ejected, which took place a few months previously. Some of this lava was still fluid, flowing slowly under a solidified crust down the slopes of the mountain. On arriving at a precipice it trickled over and became visible, forming fiery streaks. This small cone which projected from the side of the mountain would not be more than 50, or at most 60, feet high. Its sides were rather steep, particularly towards the summit, and a considerable effort was necessary to reach the mouth of the crater; which would not be more than 8 or 10 feet in diameter, and the boiling lava which emitted the vapours was only 15 or 20 feet distant from the party. The thin wall of lava on which they leant for support, and which was the only thing to prevent them slipping into the crater, was not more than 6 inches thick at the edge; but it was firm, being formed of the fused lava and scoriæ cemented together. The cloud of vapour generally filled the interior of the crater, and to the hand it felt hot and moist. Occasionally a gust of wind would blow the vapours to one side, and the red glare of the boiling-hot lava at the bottom could then be seen. Its vapours appeared white, somewhat dense, and, under the rays of the sun, had the granular or vesicular appearance of ordinary steam escaping into the atmosphere. The volume was not large, and just as it escaped from the summit of the cone it seemed to lose its vapourous appearance and to be resolved into a very thin white smoke, the surrounding dry hot air absorbing all the aqueous vapours. The walls of the crater were covered with a loose flocculent lining of a light gray colour, which adhered to the sides of the crater in the same manner as soot to the inside of a chimney, and had a depth of several inches. It seemed that this deposit was precipitated from the vapour as it ascended from the boiling lava below. Some of it was gathered close to the mouth of the crater, and an attempt was made to collect some as far down as the hand could reach, but it was too hot to be retained in the hand. Several hundredweights of this substance could have been gathered from the sides of the crater. A portion of this deposit was analysed by Mr. Michael Cochran, M.A., in the laboratory of the Glasgow University, and was found to contain per cent:—

Water	5·40
Silica	0·42
Oxide of copper	0·79
Peroxide of iron	15·43
Alumina	1·30
Oxide of manganese	0·07
Lime	0·28
Magnesia	0·32
Potash	22·04
Soda	14·10
Chlorine	4·58
Sulphuric anhydride	36·08
	100·81
Less oxygen equivalent to 4·58 Cl.	1·03
	99·78

The remarkable features of this analysis are the large proportions of potash, soda, iron, and sulphuric acid formed in the deposit, and the interesting inquiry suggests itself—"In what form did these substances exist in the molten lava? What gaseous compounds did they form when escaping from the red-hot lava? and how they would be affected on coming in contact with the atmosphere?"

Professor Phillips says that the composition of lava appears to be pretty uniform in all the periods of Vesuvian activity, and in one of the analyses quoted he gives the following as its composition:—

Silica	48·02
Lime	10·18
Alumina	20·78
Protoxide and peroxide of iron	7·97
Magnesia	1·16
Soda	3·65
Potassa	7·12
Sulphuric acid	trace
Chloride of sodium	trace
Water	trace

The guide accompanying the party imbedded a coin in the semi-fluid lava that was flowing down the side of the mountain. As the lava cooled, the coin became fixed in it. One of the party, Mr. H. J. Smith, a member of this Society, made a rough estimate of the potash, soda, and iron contained in the lava that adhered to the coin, and found the quantities of these substances to be fully as much as are given by Professor Phillips. The potash and soda exist in the state of silicates or aluminates, both of which are extremely fixed, even at very high temperatures. But in the presence of other gases a portion of the alkalies may be volatilised and separated from the silica and alumina. A very large quantity of steam is known to escape from the craters of active volcanoes. This steam would leave the lava at a very high temperature, and facilitate the escape of more or less of its volatile substances. It is well known that the presence of a gas in a liquid greatly facilitates the conversion of the liquid into vapour. Water does not of its own accord boil until it is raised to a temperature of 212° F.; but a cubic foot of air passed through it at a temperature several degrees below the boiling-point, will carry a cubic foot of steam along with it, and if alcohol, vinegar, hydrochloric acid, or other volatile liquids be mixed with the water, each would be carried off in proportion to its volatility. Glass is a species of lava containing a much larger proportion of potash or soda than natural lava. The glass maker has to protect his fused material from the hot gases of his furnace, to prevent them carrying off the potash and soda in the glass as vapour. When a piece of soft glass is kept fused for some time in the flame of a blowpipe, so much of the alkali is quickly carried away by the gases of the flame as to render the glass almost infusible. In the same manner, the steam and other gases passing through the red-hot molten lava may be expected to carry potash, soda, and other volatile substances along with them, these substances being again precipitated from the gases as they are cooled on the sides of the crater.

There is some difficulty in forming a satisfactory opinion as to where the water which forms the steam escaping from volcanoes comes from. But suppose the crust of the earth between the lava and the water of the sea to crack, and the water to rush in at the fissure, the moment it touched the hot lava it would be converted into steam, and unless the pressure be enormous the steam

formed would force the water back again. Should this action really take place, it seems sufficiently powerful to account in a great measure for the sea waves and earthquakes that accompany volcanic eruptions, and may even contribute largely to the eruption itself. A column of water having the diameter of the vent of Vesuvius and half the height of the mountain, would contain 30 to 40 million tons of water. Assuming this vast body of water to be urged from the vent into the sea with all the force that red-hot water, forming into steam, can impart to it, the rush would be powerful enough to generate a wave having inertia sufficient to carry itself so far inland as to submerge cities and leave the shipping of seaports high and dry on the land. Those who are in the habit of sailing in some of the Clyde steamers are familiar with the noise that accompanies the escape of steam into cold water when the vessel stops for passengers at the piers. Sometimes the thuds caused by the sudden condensation are so strong as to make the boat tremble. Only a very small quantity of steam is required to occasion each of these thumps as they are produced, at the rate of hundreds if not thousands per minute. If the end of the pipe that dips into the water were visible, it would be seen that the water rushes in and out with the rapidity of a weaver's shuttle, a shock being produced every time the water is drawn in and driven out. The cold water entering condenses the steam as it advances, until the water next it becomes so hot as to be unable to condense any more. The steam then forces the water out of the pipe, and as soon as the steam again comes in contact with the cold water, the same process is repeated. Now the steam that produced the wave would come in contact with the cold water of the sea. The moment it did so, it would begin to condense, forming a vacuum into which the sea-water would again rush, and, urged on by its own weight and the weight of the atmosphere, fly back towards the red-hot lava, and he lava towards it, with a force resembling the meeting of two railway trains multiplied a thousand or a million-fold. Should such an encounter take place, the sudden pressure resulting from the impact of such enormous masses at the point of junction would be sufficiently powerful to make the earth tremble.

It is difficult to conceive of conditions by which the water would force itself in amongst the fused lava, penetrating so far as to permit the steam formed to boil up through the lava at the top of the mountain. If some such conditions as exist in the Giffard injector were realised, then the water injected would become steam and produce all the effects required for an eruption. There is another way in which a quantity of water may find its way quietly into the lava. Some rocks and minerals, such as chlorite, schists, gypsum, zeolite, &c., contain a considerable quantity of water (not as water is contained in a sponge), but in chemical combination, as is the case in soda crystals. Supposing a current of lava to come in contact with such rocks, and that the temperature of the lava is sufficiently high to fuse these hydrated rocks, the water will either be relieved as a gas or steam, or retained in combination. Assuming the melting of the hydrated rocks to take place at a considerable depth, notwithstanding the very high temperature, there are several reasons for concluding that the water would fuse with the rocks, and form part of the liquid lava. First of all, the pressure may be enormous. Supposing the hydrated rock to be not lower than the base of the mountain, the pressure on it would be equal to 4000 feet of lava. A block of lava 1 foot long, having a cross section of 1 square inch area, would weigh about a pound, making the pressure on a square inch 4000 lbs., equal to 266 atmospheres. It is said that water can be made red-hot under a high pressure without being converted into steam; while it is well known that carbonic anhydride, hydrochloric acid, ammonia, and other gases can be reduced to the liquid form under high pressures, the condensation being greatly facilitated by the presence of a liquid. Under the ordinary pressure of the atmosphere, water converts many gases into the liquid form, and the greater the pressure, the greater the quantity of gases absorbed and liquefied. There are certain facts that lead to the conclusion that very moderate pressures are sufficient to retain many gases in the liquid form, even at high temperatures, when other substances are present. Thus when oxide of silver is heated to redness it loses oxygen and becomes pure silver. But if the heat be continued until the silver melts, oxygen is re-absorbed from the air until twenty to thirty times the volume of the silver is absorbed. When the fused silver is allowed to cool, the oxygen boils out of it before it becomes solid. Here we have the same relation subsisting between fused silver and oxygen as subsists between carbonic acid and water. Before freezing, water parts with its carbonic acid gas in the same manner as silver parts with its oxygen. Seeing that silver absorbs and liquefies twenty to thirty times its own volume of oxygen under the pressure of the atmosphere, how much would it absorb and liquefy under the assumed pressure of 266 atmospheres? Ironfounders are very much annoyed by the tendency which iron has to absorb gases when fluid hot, and giving it out again while cooling; and they are put to some trouble to provide for its escape in such a manner as not to injure their castings. A head of metal is formed on the mould through which the gases escape, which supplies metal to the space occupied by the gases. The head is found to be in a frothy or spongy state, something like a piece of porous slag or lava. These small gaseous bubbles or cells are found to weaken the iron very much, and Whitworth's latest improvement in gunnery is the prevention of the formation of these cells by cooling the metal under a very great pressure. The gases are thus prevented from expanding, and are retained in chemical combination with the iron. In this manner, Sir Joseph Whitworth obtains a metal strong enough to enable him to make a gun capable of sending a shot or shell 7 to 8 miles. But it is not with fused metals only that gases have a tendency to combine at high temperatures. Slag from smelting furnaces absorbs and retains gases while hot, which are given out upon cooling. In the act of separating and expanding, the gases impart to the slag all the appearance of cellular lava. When carbonate of lime, such as chalk, or limestone is heated under pressure, the carbonic acid remains in combination with the lime and a fused carbonate of lime is obtained. If the pressure is removed before cooling, most of the carbonic acid assumes the gaseous form and escapes.

When oxide of lead, litharge, is heated until it fuses, it does not give out its oxygen as silver does, but absorbs more in the same way as melted silver; and what is more remarkable, when silver or litharge is heated with steam they combine with its oxygen and leave the hydrogen free. According to Deville, the oxygen is separated from the hydrogen by the heat before it combines with the silver or litharge.

The influence of heat under certain circumstances in separating chemically-combined substances into their elements is well known, while pressure has the opposite effect of causing chemical combination. In volcanic phenomena we have these two contending influences in great force, so great, indeed, that it is impossible by mere laboratory experiments to determine the result of their combined action. Judging from what we know, however, there seems to be room to conclude that at no very considerable depth the water, carbonic acid, and other gases escaping from volcanoes are in combination with the silica, alumina, lime, potash, soda, oxide of iron, and other substances which constitute the lava, and that they form one homogeneous fluid, in which all the ingredients are intimately mixed together. Such a lava moving obliquely or perpendicularly up the vent of a cone will experience a diminution of pressure as it ascends.

The more volatile substances will begin to assume the gaseous form, generating a mass of small cells which will expand a thousandfold as they ascend, converting the lava into a species of froth, from which the gases escape, on

arriving at the crater, like steam out of a boiling-over pot, or the gases out of a soda-water bottle when the cork is removed. The steam and gases so escaping form the white cloud seen to issue from every active volcano. When the watery vapour is absorbed by the surrounding air, there remains the thin persistent cloud formed of substances similar to that found in the deposit, but in a sublimed state.

If water form a constituent of the fused lava under pressure in the manner suggested, it is easy to account for the cells of water found in the crystals of which granite is composed. If lava were permitted to cool slowly under the required pressure, the elements of which it is composed would elect to crystallise into felspar, mica, and quartz, the water separating and forming cells in the crystals. Should the lava in the volcanic vent be in the cellular or spongy state supposed, it will be very susceptible to variations in the atmospheric pressure. As the pressure increases the cells will become smaller, and as it diminishes they will expand, the body of the lava expanding with them and filling the crater sometimes to overflowing. This seems to be confirmed by observations made on Stromboli, one of the Lipari group of islands in the Mediterranean, a volcano which has been in moderate activity from the time of Homer.

Dr. Wollaston says, "the inhabitants of Stromboli positively make use of the volcano as a weather-glass. They are mostly fishermen, and while engaged in their occupation at a short distance from the island have its orifice constantly in view; and I was assured by all whom I questioned on the subject that its phenomena decidedly participate in the atmospheric changes, increasing in turbulence as the weather thickens, and returning to a state of comparative tranquillity with the serenity of the sky."

In the boiling of the vapours out of the lava, and their condensation on the sides of the crater, there is a process of distillation going on whereby the more volatile metals and their compounds are separated from the more fixed silica, alumina, and lime. In the continuous operation of volcanic action it may be asked, "How far does this distilling or volatilising action contribute to the formation of metallic veins?" Here we have the means whereby metals such as gold, silver, copper, zinc, and iron may be separated from masses of fused lava which may not contain a thousandth part of these metals. Professor Phillips mentions only a trace of copper in the lava, while Mr. Cochran found about 0·8 per cent of cupric oxide in the deposit. To what extent these volatilised metals may fill up cracks and fissures, and contribute to the formation of veins of metals, is a question for the mineralogist and the geologist. The crater of Mount Vultur, in the centre of Italy, has been a lake from the time of Horace, and gaseous exhalations still proceed from it. If the gases and vapours from the lava pass up through the water, the copper, iron, potash, soda, and other substances contained in the vapours will be taken up by the water, and certain chemical actions may take place that would precipitate the oxides of iron, copper, and other metals to the bottom of the lake.

Mr. Michael Cochran, M.A., made some remarks upon the analysis referred to in Mr. Anderson's paper. He described one specimen which he had received as a grey amorphous salt, having the appearance of a finely-divided ash. In composition it differed much from ordinary lava, no less than 84·3 per cent being soluble in water, and 99·58 per cent soluble in strong HCl. The small quantity of silica present, and the large quantity of sulphuric anhydride, indicated that it had been formed by a process of sublimation. When ignited over the Bunsen flame it lost 10 per cent of its weight, 5·4 per cent being moisture, the remainder being sulphuric anhydride, from certain of the sulphates present, and also chloride of sodium. He regarded the following as representing the form in which the substances given in the above analysis were combined:—

Sulphate of potassium	(K_2SO_4) ..	40·80
,, sodium ..	(Na_2SO_4) ..	23·13
,, copper ..	$(CuSO_4)$ ..	1·59
,, aluminium	$(Al_2 3SO_4)$ ..	3·05
,, manganese	$(MnSO_4)$ ..	0·14
,, calcium ..	$(CaSO_4)$ ..	0·68
,, magnesium	$(MgSO_4)$ ..	0·96
Sulphuric acid	(H_2SO_4) ..	0·22
Chloride of sodium ..	(NaCl).. ..	7·55
Ferric oxide	(Fe_2O_3) ..	15·43
Silicate of alumina ..	.. .. ..	0·78
Water	H_2O	5·40
		99·73

Of the above substances, manganous sulphate was the only one which he had not seen noticed by other writers as occurring in similar situations. The substance was not perfectly stable, the small quantity of free sulphuric acid present producing a slight chemical change. The sublimate gathered from the exterior of the cone by Mr. Anderson differed from the other somewhat in external aspect; one portion was of a yellow colour, the other blue, both having an irregular crystalline structure. As the quantity was small, the yellow and the blue deposit were mixed together. The following shows the composition of the mixture:—

Oxide of copper ..	(CuO)	7·75
Oxide of alumina..	(Al_2O_3)	17·34
Oxide of iron ..	(Fe_2O_3)	1·43
Lime	(CuO)	2·58
Magnesia	(MgO)	1·66
Potash	(K_2O)	4·02
Soda	(Na_2O)	3·94
Sulphuric anhydride	(SO_3)	25·80
Chlorine..	(Cl)	1·90
Fluorine..	(F) ..	Small quantity
Silica	(SiO_2)	16·90
Water	(H_2O)	17·10
		100·42
Less oxygen equivalent to 1·9 Cl..		0·42
		100·00

The substances present were thus much the same as in the previous case, but in different proportions. The chlorine present was exactly in the proportion required to combine with the iron to form ferric chloride, thus accounting for the yellow colour of one specimen; the blue colour, on the other hand, was due to sulphate of copper. After pointing out the difficulty of supposing that the presence of the above-named substances in the volcano could be explained by the introduction of sea-water, he went on to show how their presence might be accounted for. The alkalies would be derived from the lava itself, particularly from the more trachytic or felspathic sort, which is richer in alkalies and contains less of the ferruginous minerals. The alkaline silicates would be partly taken into solution by the interstitial water, which exists in all lavas while in the molten condition. Solution would be assisted by carbonic acid derived from the strata through which it ascended, and possibly also by a sulphur acid. The subsequent reaction of sulphuric acid upon the dissolved silicate or carbonate would account for the fact of its being found in the form of sulphate. The sulphuric acid he thought would be derived from sulphides of the metals iron, &c. For, though iron pyrites was easily decomposed by heat at ordinary pressures, there was reason to believe it could exist at a high temperature if subjected to great pressure, it being a common constituent of the crystalline as well as of the sedimentary rocks. When the metallic sulphides arrived at a part of the volcanic vent suitable for oxidation, they would lose their sulphur, which would be burned to sulphurous anhydride, and in the hot moist atmosphere of the cone would be further oxidised to sulphuric acid.

Mr. Anderson's paper was illustrated by numerous

specimens of volcanic products, a number of which were collected in the year 1866 by Mr. Wünsch, a member of the Society, and by whom they were lent for the occasion.

An interesting discussion ensued, in the course of which Mr. Wünsch and Mr. Ogilvie gave some of their own observations made on Vesuvius, Etna, the Lipari Islands, &c. Mr. Tatlock, the President, and other gentlemen, also took part in the discussion. Some degree of surprise was expressed at the non-appearance of ammonium chloride in the results of Mr. Cochran's analysis, but that gentleman said he had purposely sought for it, and had failed to find any. In one of the deposits Mr. Anderson stated that Dr. Thorpe had found, by spectrum analysis, lithium in sensible quantity.

NOTICES OF BOOKS.

A Manual of Elementary Chemistry. By George Fownes, F.R.S., late Professor of Practical Chemistry in University College, London. Eleventh Edition. Revised and corrected by Henry Watts, B.A., F.R.S. London: J. and A. Churchill. 1872.

Our students will welcome this new edition of Fownes's "Manual." It is printed in bolder type, and contains many additions to the subject of organic chemistry, as this division of chemical science is generally treated in handbooks. Mr. Watts's name is sufficient recommendation that the most recently-established facts have been included in the work. There is, however, one objection to the enlarged form—the volume becomes rather too bulky. This indeed is the most serious fault to be found with the book. The edition is a valuable one, and students should hasten to procure a copy.

Notes for My Students.—Magnetism. By William J. Wilson, F.C.S. London: J. Bale and Sons. 1872.

This is a valuable addition to the many handbooks for students in Physical Science. It will be useful to the candidate for examination, or will afford notes to the lecturer.

MISCELLANEOUS.

Analyst and Medical Officer of Health for Birmingham.—At a special meeting of the Birmingham Town Council held on the 17th inst., the Mayor presiding, the Sanitary Committee recommended that candidates for the two offices mentioned above be advertised for at the salaries of £150 and £500 respectively; an amendment was, however, proposed by Mr. Rolason that Dr. Alfred Hill, the present borough analyst, be appointed to the two offices at the salaries named. This was seconded by Dr. Barratt. The motion was unanimously adopted by the Council, and Dr. Hill was accordingly appointed Medical Officer of Health for the borough.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, December 16, 1872.

This number contains, in addition to several memoirs relating to astronomy, meteorology, physics, natural history, and mechanical sciences, the following original papers relating to chemistry:—

On a Meteorite which fell near Baudong (Java) December 10, 1871, presented to Musée d'Historic Naturelle at Paris, by His Excellency the Governor-General of the Netherlands' East Indies.—M. Daubrée.—It appears from this exhaustive account that several rather large-sized meteoric stones fell on the same day at or near the locality above mentioned. According to the analysis of Dr. Vlaanderen, the stone consisted percentically of:—Nickeliferous iron, 2·81; sulphuret of iron, 5·44; chrome iron, 4·41; peridote, 47·26; augite, 20·98; felspathic mineral; 17·0; total 97·90. 60·17 per cent of this stone is soluble in HCl. Its sp. gr. is =3·519.

Detection of Bromine and Iodine in Native Phosphates of Lime.—F. Kuhlmann.—This paper opens with a review on the geognosy of the native phosphatic minerals, and on the occurrence occasionally observed of iodine and bromine in small quantity in some of these (as, for instance, the phosphorite of Staffel, near Limburg-on-the-Lahn). Next the author calls attention to the fact that when the phosphatic minerals of the Lot, and of the Tarn and Garonne Départements are treated with sulphuric acid on the large scale, vapours of iodine are distinctly seen; but on a minute investigation of the minerals the quantity of iodine, accompanied by some bromine (a very minute trace), is found to be exceedingly small.

On some of the Derivatives from the Oxychlorides of Silicium.—L. Troost and P. Hautefeuille.—This memoir treats on the action of the oxychloride of silicium, $Si_8O_8Cl_8$, upon alcohol. By a rather complex process of operation there is obtained an ether,—

$$(C_4H_5O)_8Si_8O_{16}$$

a mobile clear liquid; sp. gr. at 0°=1·071; vapour density at 350° (boiling-point of mercury), 19·54. The ether is soluble in alcohol, and in ordinary ether, but not in water which gradually decomposes it, silica being precipitated. The authors next give an account of the action of ammonia on this ether, the result being the formation of an oily fluid, $(C_4H_5O)_7Si_8O_{15}NH_2$; but by prolonged action of ammonia upon the ether alluded to, several other compounds are formed.

New Method of Producing Ozone by Means of Charcoal (Gas-retort Graphite).—A. Boillot.—The description of a series of experiments whereby, the graphite being used as a conductor of electricity, pure and dry oxygen is slowly and partially converted into ozone.

Estimation of the Quantity of Oxygen Dissolved in Rain and Seine Waters.—A. Gérardin.—By Schützenberger's process (described in Chemical News, vol. xxvi, p. 204) the author has estimated the quantity of oxygen in rain-water which has fallen at various dates, from October 29 to December 8 last, and also in Seine water. The largest quantity of oxygen to the litre found in the former was found to amount to 8 c.c. per litre, in the latter to 6 c.c. The smallest quantity of oxygen in rain-water amounted to 2·59 c.c. to the litre; and in Seine water, to 3·33.

Journal für Gasbeleuchtung und Wasserversorgung, No. 20, 1872.

The original papers contained in this number strictly relate to matters pertaining to gas- and water-works engineering and management.

No. 21, 1872.

In addition to subjects specially relating to gas- and water-works engineering and management, we meet here with—

Analysis of the Water now Supplied to the Town of Wiesbaden.—Dr. R. Fresenius.—Hardness of the water between four and five. Composition in 1000 parts:—Sulphate of potassa, 0·0024; chloride of potassium, 0·0003; chloride of sodium, 0·0067; nitrate of soda, 0·0013; nitrate of lime, 0·0006; carbonate of lime, 0·0116; carbonate of magnesia, 0·0107; silica, 0·0081; organic matter (expressed by the quantity of oxygen required for its complete oxidation), 0·0007.

Water Supply to the Buildings of the Great International Exhibition to be held in Vienna in 1873.—T. Wieck.—The total quantity of water to be supplied for all purposes, inclusive of fountains, driving of machinery, &c., amounts to 1240 cubic metres per hour,—a quantity sufficient for a population of 200,000.

Bulletin de la l'Academie Imperiale des Sciences de St. Petersbourg, Vol. xvii., No. 5, 1872.

This number contains, in addition to original memoirs relating to other sciences, the following original memoir containing chemical information:—

Microscopical Investigation of the Sanative Mud met with in the Salt-Water Lakes Sak and Mainak, Crimea.—N. Jelesnow.—The mud of Sak was found to contain, by Goebel, in addition to some water, gases, and soluble salts, the following quantities per cent of other substances:—Organic matter, 2·7: sand found to contain—silica, 22·25 per cent; peroxide of iron, 7·24; alumina, 4·25; magnesia, 0·25 (this analysis was made in 1838). Hasshagen analysed the mud in 1849, and found, in addition to carbonate, phosphate, and sulphate of lime, the following constituents per cent:—Silica, 31·80; peroxide of iron, 9·52; alumina, 8·30; magnesia, 5·82; organic matter, 3·75. The mud of Lake Mainak and the water of that lake have been analysed by Major-General Iwanow, and found to contain respectively in 100 parts—the mud; carbonate of lime, 28·99; carbonate of magnesia, 3·69; chloride of sodium, 8·565; chloride of magnesium, 0·793; sulphate of lime, 3·79; sulphate of magnesia, 0·457; bromide of magnesium, a trace; sand and clay inclusive, 3 per cent; organic matter,

20·81; water, 30·00. It appears that these muds are used medicinally as baths in some forms of gout and chronic rheumatism.

La Revue Scientifique de la France et de l'Etranger, December 14, 1872.

This number contains no papers relating to chemistry, but we call attention to the following memoirs:—

What we Gain by the Use of Manure in Agriculture.—G. Ville.—The continuation of the author's lectures on practical agriculture at Vincennes.

The Part Played by Glaciers in Geology.—A. De la Rive.

The Spectrum Exhibited by the Metalloids.—G. Salet.—An abstract of the author's inaugural dissertation read before the Faculty of Sciences at Paris.

Bayerisches Industrie und Gewerbe-Blatt, November, 1872.

This number contains no original papers relating to chemistry.

Bulletin de l'Academie Royale des Sciences, des Lettres et de Beaux Arts de Belgique, Nos. 9 and 10, Double Number, 1872.

This number contains no papers relating to chemistry.

American Journal of Pharmacy, December, 1872.

The original papers and essays contained in this number only relate to pharmaceutical sciences.

Revue Hebdomadaire de Chimie Scientifique et Industrielle, November 21, 1872.

The Soap-boiling Industry at Dijon.—Sirandré and Co.—The detailed account of the methods of preparation of soap as carried on at the works of the parties referred to.

Similihuile, a Liquid to be Applied Instead of Linseed Oil. M. Petit.—It appears that the author has succeeded in preparing a liquid—the nature, composition, and mode of preparation of which is not specified—which while it possesses all the valuable qualities of linseed oil, does not, when mixed with pigments and applied to iron, wood, or other objects, become deteriorated by exposure to weather, and is not affected by heat as linseed oil is.

Moulin-Mercier.—Under this heading an account is given of an improved mill-work for grinding corn. The main advantages of this contrivance are,—that less motive power is required; that the millstones have to be less frequently burred; that the flour does not become heated, and that consequently a larger yield of flour as well as a better quality is obtained.

November 29, 1872.

Ceresine, a New Hydrocarbon which may be Employed as a Substitute for Bees'-Wax.—Ch. Mène.—It appears that ceresine is a by-product of the industrial process employed for purifying the native ozokerite met with in Austria, which is used for the purpose of obtaining paraffine. The crude ceresine is treated with sulphuric and sulphurous acids, and, lastly, with alkalies: the pure article is a white-coloured, semi-transparent, opaline body, void of taste and smell, fusing at from 61° to 63°, sp. gr. 0·880, insoluble in water, soluble in alcohol, not saponified by alkalies. Ceresine is used in Vienna instead of wax in some pharmaceutical preparations.

Description of a New Instrument for Taking Levels.—M. Bigot.—Illustrated by woodcuts.

Bibliography.—Under this heading the following work is quoted:—"La France Industrielle, ou Description des Industries Françaises," par M. P. Poiré, Professeur à l'Ecole Industrielle d'Amiens; 1 vol., 755 pp., 432 engravings; price 10 francs; Librairie Hachette, Paris. This work is highly spoken of, and is useful both for schools and for general reference.

Les Mondes, December 12, 1872.

Le Fondateur des Mondes et des Salles du Progrès.—Victor Fournel.—The article here reproduced from *Le Francais* is called attention to as containing some biographical particulars of the excellent and reverend editor of *Les Mondes*, who, according to the testimony of Dumas, as lately publicly stated by him in a meeting of the Academy of Sciences, "marche depuis près d'un demi-siècle à la tête du mouvement scientifique en France;" and who, next to the late A. Dumas, has written and edited more books than any one else in France.

Tachymètre.—P. Dupont.—Under this heading a short account is given of an instrument which appears to be devised for the purpose of rendering the teaching of geometry a rapid and pleasant course at schools; M. Lagout has given some lectures to prove this at Clermont-Ferrand, the result being that the *Maire* and the *Recteur* have decided that tachymetry shall be introduced into the schools under their control. The instrument is made in three different sizes, at the price respectively of 10, 21, and 100 francs; it is for sale at 41, Rue J. J. Rousseau, Paris.

Cause of the Blue Colour of the Sky.—M. Collas.—The author first refers to the blue colour exhibited by the pure water of certain lakes, and says that it is due to the therein dissolved or very minutely divided gelatinous silica, quoting as instances the lake of Genève, the water of the d'Huis, and more particularly the water of a source near to the Mont-Dore (Département du Puy-de-Dome), which water is even bluish-coloured when placed in a white glass decanter. The blue colour of the sky is referred by the author to the same cause, viz., very finely divided gelatinous silica (hydrated silica) kept in suspension in the clouds on account of its great lightness.

PATENTS.

Communicated by Messrs. VAUGHAN and SON, Patent Agents, 54, Chancery Lane, London, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3160. W. T. Cooper, Oxford Street, Middlesex, "Improvements in preparing or making up medicated and other effervescing mixtures."—Petition recorded October 24, 1872.

3232. W. T. Cooper, Oxford Street, Middlesex, "An improvement in the manufacture of lozenges."—Petition recorded October 31, 1872.

3464. E. Hills, Warsash, Hampshire, and E. Biggs, Laurence Pountney Hill, London, "Improvements in deodorising and purifying sewage and other excrementitious matters, and in obtaining certain useful products therefrom."—Petition recorded November 20, 1872.

3477. P. Jensen, Chancery Lane, Middlesex, "Improvements in the manufacture of steel."—A communication from T. Brooks, Minerva, Stark, U.S.A.—Petition recorded November 21, 1872.

3628. C. Von Hennings, "The preparation of an extract from the berries of the mountain ash (Pyrus), (German, Eberesche)."—Petition recorded December 2, 1872.

3642. C. W. Siemens, Great George Street, Westminster, "Improvements in smelting iron and steel, and in furnaces and apparatus employed in connection therewith, parts of which improvements are also applicable to regenerative gas furnaces generally."

3643. F. J. Bolton, Grosvenor Mansions, Westminster, "Improvements in compounds for coating leather in order to render it more endurable and less pervious to moisture."—Petitions recorded December 3, 1872.

3668. W. E. Newton, Chancery Lane, Middlesex, "Improvements in the manufacture of cast-steel, and in refining pig- or cast-iron."—A communication from B. Gloeckner, Tschirndorf, Prussian Silesia.

3670. H. Y. D. Scott, C.B., and T. W. Scott, Ealing, Middlesex, "Improvements in the mode of, and apparatus for, preparing lime for the treatment of sewage."—Petitions recorded December 4, 1872.

3676. F. G. Morton, Bermondsey, Surrey, "An improvement in treating tin-plate waste scraps or clippings for separating or removin the tin and other matters from the iron."

3678. W. R. Lake, Southampton Buildings, London, "Improvements in the manufacture of malleable cast-iron and cast-steel, and in furnaces therefor."—A communication from J. M. Roberts, Burlington, New Jersey, U.S.A.

3680. T. Petitjean, Islington, Middlesex, "Improvements in the production of metallic surfaces and articles of various forms by chemical means and the electro-deposition of metals, which surfaces or articles are produced either highly polished, dead or matted, engraved, or otherwise ornamented."—Petitions recorded December 5, 1872.

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NOTICES TO PROCEED.

2328. E. Packard, jun., Ipswich. Suffolk, "Improvements in the manufacture of superphosphate of lime and artificial manure."—Petition recorded August 3, 1872.

2342. W. R. Lake, Southampton Buildings, London, "An improved ink-erasing compound."—A communication from J. C. de Voy, San Francisco, California, U.S.A.—Petition recorded August 6, 1872.

2369. W. R. Lake, Southampton Buildings London, "Improved nutritious compounds."—A communication from J. R. Weed, New York, U.S.A.—Petition recorded August 9, 1872.

2403. A. M. Clark, Chancery Lane, Middlesex, "A new or improved medicinal compound."—A communication from C. V. Viard, Paris, France.—Petition recorded August 12, 1872.

2649. W. Meister, Dr. E. Lucius, and Dr. A. Brüning, Hoechst, near Frankfort-on-the-Maine, Germany, "Improvements in the manufacture of colouring-matter suitable for dyeing and printing."—Petition recorded September 6, 1872.

2672. E. Withy and W. Gibson, West Hartlepool, Durham, "Improvements in puddling furnaces, and in preparing iron for being operated upon therein and charging, such improvements in preparing for and charging being applicable in connection with cupolas, vibratory, and refinery furnaces."—Petition recorded September 9, 1872.

3330. A. C. Pelly, Finch Lane, London, "Improvements in the manufacture of peat-fuel, and in the machinery and apparatus therefor."—A communication from L. Von Hom, Stockholm.—Petition recorded November 9, 1872.

PATENTS SEALED.

1769. J. Dupont, Nimes, France, "The application and treatment of certain plants not hitherto used for the production of filaments and fibres."

1770. J. Birch, Newton Heath, Lancashire, "Improvements in the manufacture of iron and steel, and in apparatus to be used in such manufacture."—Dated June 12, 1872.

2930. J. G. N. Alleyne, Alfreton, Derbyshire, "Improvements in apparatus for the manufacture and refining of sugar and rum or other spirit."—Dated October 4, 1872.

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